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U.S. DEPARTMENT OF COMMERCE
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Dr. Robert M. White, Acting Administrator

NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: Alaskan woman has elemental tie to other natives.
(S. Hadwen)

COMMERCIAL FISHERIES
Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

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Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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CONTENTS

A RARE MEETING OF 9 NOAA SHIPS AT PACIFIC MARINE CENTER, SEATTLE, WASH. Seven serve the National Ocean Survey; two, the National Marine Fisheries Service: Miller Freeman (1), George B. Kelez (2). (Photo: Larry Dion, Seattle Times)

U.S. & USSR HOLD SCIENTIFIC EXCHANGE ON NORTHEAST PACIFIC FISHERY PROBLEMS

U.S. and Soviet delegates met in Moscow, Dec. 3-9, 1970, to exchange data on the biology and status of Pacific hake and rockfish (including Pacific ocean perch). They sought to coordinate objectives and organize joint research on hake and rockfish in 1971. They discussed ways to improve the methods of estimating the abundance of Pacific hake and rockfish. They discussed, too, the effect of the Pacific hake fishery on other fish caught incidentally.

Pacific Hake

Both sides agreed that commercial-size stocks continue to decline due to gradual elimination of abundant 1960-61 year-classes and replacement by less-abundant 1962-65 year-classes.

Soviet data appear to indicate that 1966-67 year-classes are stronger than 1962-65 classes. The entry of 1966-67 classes into commercial fishery in 1971-72 will improve commercial hake stocks--compared with 1969.

U.S. age frequency data collected off Washington and Oregon do not corroborate Soviet view. However, both sides agreed that 1966-67 year-classes are not as abundant as 1960-61; that smaller 1962-65 year-class sizes resulted from natural causes, not from effects of commercial fishery.

Pacific Ocean Perch

Both sides agreed that stocks in Oregon-Vancouver Island area continue to need protection. Preliminary Soviet data from early 1970 hydroacoustic surveys indicate increase in 1970 standing stock off Washington-southern Vancouver Island. The figure is about 40,000 metric tons, compared with 33,000 tons in 1969. Also, concentrations of young fish suggest beginning of rehabilitation. The data, however, need to be refined. No improvement was seen in stock condition off Oregon.

Other Rockfish

Soviet hydroacoustic and trawl surveys in Jan.-March 1970 estimated standing stocks of all species off north California, Oregon, Washington, and southern Vancouver Island at about 350,000 metric tons. About 75% are distributed off Washington and southern Vancouver Isl.; 20% off Oregon; 5% off California.

'Sebastodes flavidus' accounts for 65%--half of this off Washington. This indicates no substantial change from 1969 assessment and species distribution. S. flavidus stocks also show no adverse effects from recent commercial fishing. Stocks of other rockfish species (S. proriger, S. diploproa, S. crameri) are considered by both sides to be at very low level and to require protective measures.

Shrimp

Both countries recommended joint investigations. These will include changes in condition of different populations under fishery pressure, seasonal migration, and distribution on Continental Shelf in Gulf of Alaska in 1971.

The Soviets will assign 'R/V Kril' in Jan.-Mar. 1971 on high seas from Sanak Island to North Portlock Bank. (Contiguous fishery zone will be included if U.S. permits.) The U.S. will assign 'R/V Oregon', Apr.-Sept., and 'R/V Resolution', Apr.-May, to operate off Kodiak Island. Scientists will be exchanged.

Joint Research

(a) Ichthyoplankton studies: Hake fecundity data will be collected by U.S. in main spawning area from Dec. 1970-Feb. 1971; then jointly by U.S. and Soviets in Dec. 1971-Feb. 1972. Data will be processed by the U.S.

(b) Hydroacoustic studies: The U.S. will determine statistical variance of hydroacoustic surveys. The Soviets will develop computer techniques for processing the data, and determine best times and areas to survey feeding hake and rockfish. Research programs will be exchanged 3 months after the meeting.

(c) Hake and Rockfish Surveys:

A Soviet research vessel will assess abundance of feeding hake and Shelf rockfish species in July-Aug. 1971 along U.S. coasts between 37° and 52° north latitude; in

Aug.-Sept. 1971, it will study biology and estimate relative abundance of hake between 20° and 40° north latitude.

A U.S. vessel will conduct an ichthyoplankton survey in winter 1971-72 to determine spawning hake abundance.

A Soviet research vessel will study in winter 1971-72, between 23° and 40° north latitude, the distribution and formation of hake concentrations during wintering and spawning periods; it will assess spawning stocks by hydroacoustic methods.

The research will be carried out by both sides for years.

(d) Blackcod (sablefish) Studies:

A program to be approved by March 1971 will determine blackcod studies in northeast Pacific--distribution, migration, behavior. The program will be begun in 1971.

Salmon

The Soviets denied taking any salmon in incidental catches. They will make available "detailed" catch data--but no vessel logs.

Hake Catch Rates

Preliminary Soviet 1970 data indicate catch per commercial tow from Oregon to Vancouver Island at 1969 level: 4.5-5.5 tons for BMRTs, 4-4.5 tons for SRTMs. By Dec. 1, 1970, the total Soviet hake catch was about 170,700 tons.

The U.S. team was led by D. L. Alverson, Associate Regional Director, NMFS, Seattle. It included Federal and State officials from Washington, Oregon, and Alaska.

The Soviet team, led by P. A. Moiseev, Deputy Director, Soviet Federal Fisheries and Oceanography Research Institute (VNIRO), included representatives of VNIRO and Pacific Fisheries and Oceanography Research Institute (TINRO).

U.S. AND JAPAN CONCLUDE FISHERY AGREEMENTS

Effective Jan. 1, 1971, two-year agreements between the U.S. and Japan extend and modify fishery arrangements between the two for the past several years.

One agreement involves king and tanner crab fishing in Bering Sea, the other fishing off Alaska and the U.S. Pacific Coast.

Crab Fishing

The new agreement on crab fishing reduces Japan's quota of king crab for each of the next 2 years by 56%, from 85,000 cases to 37,500. The change was based on agreement by scientists that previous regulatory measures were inadequate for conservation.

During 1970, Japanese fishermen harvested 18.2 million tanner crabs; this has been lowered to 14.6 million, plus allowance of 10%. The lower limit reflects concern over effect of rapidly expanding fishery on tanner crab stocks.

These measures, new gear in crab fisheries, and continuation of crab pot sanctuary in which no tangle-net fishing will be allowed, should improve conservation and facilitate crab fishing by U.S. fishermen.

Principal changes in the second agreement include:

Closed Areas Off Kodiak

Japan agreed to a 70-day extension of the period during which six areas off Kodiak are closed to Japanese trawling and longlining. The closure will be in effect August 20 through April 30. Under the previous arrangement, Japan agreed to refrain from fishing in these six areas from September 1 through February.

Special Halibut Areas

The closed halibut area in Seward Gully area was divided in two; one will extend northward from present location. The Chirikof area was changed slightly and extended northward.

Davidson Bank Area

Japanese dragnet and longlining will not be permitted between September 15 and February 15 in Davidson Bank area, an important king-crab fishing ground. This change gives Japan an additional month of fishing time, conforming to change in U.S. king-crab season.

Eastern Bering Sea Halibut Grounds

Under former arrangement, Japan agreed to refrain from trawling at night only in a large elongated area during first 12 consecutive days of halibut season. This proved unsatisfactory to U.S. fishermen. So three new separate areas (Polaris, Misty Moon, and Corridor Grounds) were established. Japan agreed to refrain from trawling, both night and day, for first six consecutive days of halibut season in each of these three areas.

Contiguous Fishery Zone, Aleutian Islands

Japan agreed to refrain from trawling and longlining in 3-12 mile zone over much of king-crab fishing area during U.S. crab season.

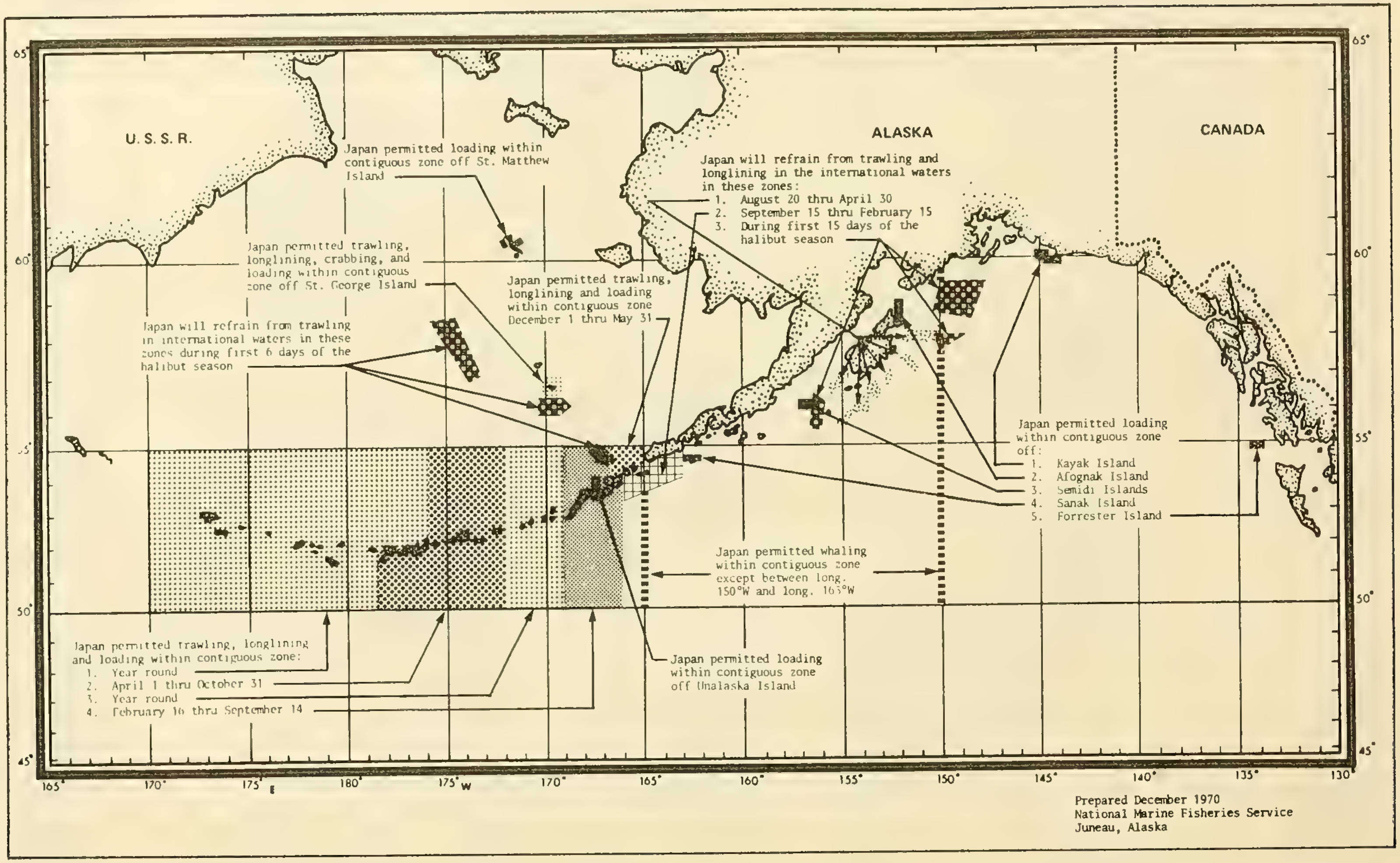
Fishing Off St. Paul Island

Japanese vessels previously fished in 3-12 mile zone off St. Paul Island, the largest and by far the most important fur seal rookery in Pribilof Islands. However, detection of oil spillages, and reports of fur seals with discarded fishing materials, such as pieces of webbing, entwined around their necks, led to agreement that Japanese will refrain from fishing in 3-12 mile zone off St. Paul Island throughout the year in order to protect seals and their environment.

Loading Zones Provided by U.S.

In return for Japanese concessions, the U.S. added three new loading zones to the five granted under former agreement. The new zones are located near Semidi Island (Gulf of Alaska), St. Matthew Islands (Bering Sea), and in a corridor near Makushin Bay, Unalaska Island.

Japanese fishing vessels will be permitted to enter and anchor within 3-12 mile zone to gain protection from the elements and to transfer cargo.



U.S.-Japan Fisheries Agreements Concerning the U.S. Contiguous Fishery Zone Off Alaska, December 1970.

U.S.-Japan Fisheries Agreement on the U.S. Contiguous Fisheries Zone Off the Pacific Northwest, December 1970.

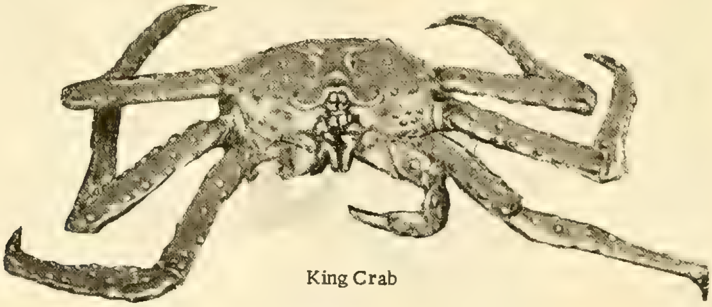
There were extensive discussions on the condition of bottom fish, especially Pacific Ocean perch and black cod. It was agreed that prudence is required to insure conservation of Pacific Ocean perch. Both countries, acting primarily through International North Pacific Fisheries Commission, will intensify research to achieve more adequate evaluation of this resource. The special arrangement regarding Japanese fishing, and its effect on ocean perch off Washington and Oregon, will continue.

Both nations agreed to seek maximum enforcement of agreements and to prevent pollution by their fishing operations.

The Representatives

The changes were worked out by representatives of the two governments in Tokyo during November 1970. The U.S. delegation was headed by Ambassador Donald L. McKernan, Special Assistant to the Secretary of State for Fisheries and Wildlife. NMFS representatives included Donald R. Johnson, Regional Director, Pacific Northwest region, and Harry L. Rietze, Regional Director for Alaska, other technical experts, representatives of State Governments, industry spokesmen from Alaska, Washington, and California, and a consultant from the International Pacific Halibut Commission.

The Japanese delegation was led by Yoshio Okawara, Acting Director-General of American Affairs Bureau of Japanese Ministry of Foreign Affairs.



King Crab

Tanner Crab
(Chionoecetes tanneri)

Halibut

FISHERY PRODUCTS SITUATION

Donald R. Whitaker
NMFS Current Economic Analysis Division

Demand for fishery products was strong in 1970 as evidenced by rising consumption and rising prices. Per-capita consumption rose 2%--from 11.1 pounds in 1969 to 11.3 pounds in1970. Per-capita consumption rose for the third consecutive year to the highest level since 1953. Prices of fishery products averaged about 10% higher in 1970--nearly double the increase in overall food prices.

Per-capita consumption rose 0.1 pound for fresh and frozen fish and 0.1 pound for canned fishery products. The fresh and frozen trade was marked by strong advances in total consumption of such products as shrimp, salmon, fish sticks, fish portions, and groundfish fillets. Demand for groundfish fillets, particularly cod fillets, was very strong in 1970. Consumption of cod was sparked by the gradual growth in cod fillets marketed through grocery stores and in restaurants--and the fast-growing fish-and-chips franchise chains.

Increased consumption of canned fish was associated with sharply higher production of canned shrimp and canned salmon than in 1969. Production of canned tuna continued its long-run growth pattern.

As 1971 Began

At the beginning of 1971, supplies of most fishery products appeared ample for trade needs prior to the Lenten season. On January 1, 1971, inventories of frozen fishery products were 11% above previous carryover.

Inventories of frozen fillets on January 1 were 17% above a year earlier. Flounder, ocean perch, and whiting fillets were more plentiful; stocks of cod and haddock were below year-earlier levels. Headed-and-gutted whiting will also be plentiful during the early months of 1971. About $2\frac{1}{2}$ times more frozen salmon were in storage than last year. Inventories of frozen fresh-water fish were about the same as a year ago.

Shrimp are expected to be plentiful in early 1971--based on 14% higher stocks in cold storage on January 1. Stocks of crabs and scallops were about the same, while lobster tails were below early-1970 levels.

Fish Sticks, Portions, Blocks

Inventories of fish sticks and fish portions at the start of 1971 were 11% below a year earlier. Stocks of sticks and portions likely will continue below year-earlier levels in the coming months. Inventories of fish blocks, the raw material for sticks and portions, were 29% below 1970.

The present supply situation indicates some tempering of the rapid increase in fish prices that prevailed throughout 1970. Although fish prices will average higher than a year ago, they probably will not match the 10% jump of 1970, especially in the first half of 1971.

1970 ALBACORE LANDINGS TOP 1969's

Preliminary U. S. west coast landings for 1970 albacore season are 55 million pounds (27,500 tons). The 1969 total was 50.5 million pounds (25,250 tons); the 1960-1969 average 45.7 million pounds (22,850 tons). This was reported from NMFS La Jolla, Calif., by R. Michael Laurs, leader, Fishery-Oceanography Group.

At the end of Nov. 1970, a few jig boats were still fishing, weather permitting, off central California, mainly between Monterey and Morro Bay. However, additional catches were not expected to boost significantly the 1970 total.

The higher 1970 landings probably reflect increased fishing effort. The Western Fish Boat Owners Association said more boats fished albacore in 1970 than in 1969.

Preliminary 1970 California albacore landings were 28.1 million pounds, up about 91% from 1969. The aggregate Oregon, Washington, and British Columbia landings were 26.9 million pounds, down about 28% from 1969.

Preliminary landings in millions of pounds by states:

	1970	1969
California	28.1	14.7
Oregon	22.5	29.8
Washington	2.9	3.5
British Columbia	1.5	2.5

Highlights of 1970 Albacore Season

The first reported catches of albacore tuna in 1970 were made by NMFS 'David Starr Jordan' on a preseason scouting cruise off California and Oregon, June 22-July 2. Three albacore were taken near San Juan Seamount; about 100 were taken between Point Sur and Point Arena, about 300 miles offshore.

The albacore price settlement of $550 per ton delivered to canneries was reached on July 15. The season started fast, with good fishing in Eureka-Crescent City area. Smaller catches were made off central Oregon. However, good fishing off northern California lasted only a few days as high winds and seas developed. By July 20, the fishery had moved north.

Off Oregon

The best fishing since 1967 was reported off Oregon during last week of July. Landings in Astoria were at record rate. Although 1970 season started 15 days later than 1969, July landings were well over double those in July 1969. However, after almost-record landings of nearly 4,000 tons for July, the albacore jig fishery off Oregon collapsed during first week of August. It was unexpected and abrupt. The fishery did not revive.

Despite large-scale scouting during first week of August, fishermen failed to get back on the fish in offshore area from southern Oregon to Vancouver Island. However, on August 5, indications of good fishing and fair weather were found off northern California. Unfortunately, the traditional windy weather there resumed and caused most of the fleet to return to Eureka by August 9. High winds and sloppy seas seriously hampered fishing. By August 11, part of the fleet returned to sea off northern California and reported good fishing in rough weather.

Southern California

While albacore fishing off Oregon ebbed during first-half August, it increased off southern California to best level in about 3 years. A small fleet began fishing near the 213 fathom spot off San Diego during first week of August. It averaged about 100 fish (mostly 20-25 pound) per day; some single day scores were as high as 250 fish. Fishing continued at this level, mostly by small bait boats, for about a month. Landings in San Diego were highest in several years.

Excellent jig fishing was reported on August 18 in area near compass rose outside San Juan Seamount: some 1,000 fish scores and many 600 fish scores. A large fleet of jig boats quickly gathered from Rodriquez Dome to San Juan Seamount to about 80 miles southwest of Point Arguello. Good fishing on 11-15-pound albacore continued for about a week. Catches averaged 250-300 fish per day. But by August 25, because of poor fishing and high

winds, most of fleet moved northward to Point Arena and San Francisco.

Off Oregon & Washington

By mid-August, most larger California bait boats were fishing off Oregon and Washington. The best catches were made during September: some days several boats reported 20-25 tons per day. However, for the most part, bait-boat fishing in northwest was only fair; catches ranged from 2-10 tons per day.

Rough weather along central and northern California prevented jig fishing in any one area for more than a few days during first-half September. A few larger jig boats were able to fish during rough weather. But most boats were locked into ports from Eureka to Morro Bay during greater part of this period.

Off Central California

Excellent jig fishing developed in a large area off central California during third week in September. The main activity was centered near and outside Monterey Seavalley. Good catches also were reported about 30 miles southwest of Point Sur and outside Davidson Seamount. High winds and rough seas slowed fishing for a few days during third week of September. Most boats were forced into central California ports. As winds abated, the large fleet quickly got back on fish. By Sept. 26, excellent fishing, associated with fair weather, was reported from Morro Bay to Point Arena. Fair weather during third week of September also allowed very good fishing in a large area about 80 miles offshore between Cape Mendocino and Eureka. However, by September 22, most boats had left northern California waters because of high winds and lack of fish.

During first 2 weeks of October, the catches off northern and southern California declined. Fishing effort was narrowed to central California region (off San Francisco, Monterey, and Morro Bay). Most bait boats fishing off Oregon and Washington moved to California waters to end their season. The season was essentially over by second week of November, but a few boats still were catching small numbers of fish, mainly between Monterey and Morro Bay, at end of November.

Jordan's Cruise

The David Starr Jordan conducted an 18-day albacore-oceanography cruise in October. The purpose was to investigate migration route followed by albacore leaving American west coast near end of fishing season. Data were collected to determine if albacore migrate out of American fishery along boundary of transition zone between north Pacific and central Pacific waters.

The cruise had two parts. In Part I, Jordan made a rapid north-south oceanographic transect between latitudes 35-43° N. along longitude 140° W.; the resulting data were analyzed aboard. In Part II, standard techniques were used to make detailed fisheries investigations in north Pacific, central Pacific, and transition zone indicated by environmental conditons during Part I. Part II included trolling 12 jig lines during daylight and observing the life history of albacore tuna by study of gonads, stomach contents, liver, and other vital statistics. Oceanographic observations were made during night hours to measure distribution of environmental characteristics associated with migration of albacore and season's end off American west coast.

Findings

Sea-surface temperatures measured were very near or above upper limit of optimal temperature range for albacore in all waters, except subarctic waters. Albacore were caught only in subarctic waters (six landed and five lost); small numbers of dolphinfish, Coryphaena, were caught in transition zone and north Pacific central waters. Albacore were migrating along a route associated with their optimal temperature range, rather than along a boundary between water masses. Fishing effort was limited (8-12 lines fished 13-24 hours in each water mass) due to rough weather and other reasons, and catches of albacore were small. So the results were inconclusive.

'KELEZ' CONDUCTS SALMON RESEARCH FISHING CRUISE

The 'George B. Kelez' of the National Marine Fisheries Service (NMFS) left Seattle, Wash., January 12 for a 7-week winter salmon research cruise in the North Pacific Ocean. The expedition members will fish from 49° N. to 53° N. along 160° W. and 165° W. and from 166° W. to 176° W. between 50° N. and 51° N. They are using monofilament and multifilament nylon gill nets of various mesh sizes. About 3.3 km of gear are being fished nightly. Oceanographic observations include daily bathythermograph and continuous surface salinity readings.

Cruise Purpose

The cruise is part of continuing research on the ocean distribution of salmon. It is being carried out for the International North Pacific Fisheries Commission. Purpose of the fishing is to obtain an index of abundance of maturing Bristol Bay sockeye salmon in the northeastern Pacific. When this is compared with indices obtained during past winter cruises, it will aid in forecasting the 1971 salmon run to Bristol Bay.

Bristol Bay Sockeye

Bristol Bay sockeye salmon are one of the most important U.S. salmon resources. In 1970, the run (catch and escapement) was close to 46 million fish; of the total, about 22 million were caught commercially. The commercial catch was worth about $26 million to fishermen.

This species is distributed widely and part of the run is caught each year by the Japanese mothership salmon fishing fleet.

Westward to Mid-Aleutians

Besides the research in the northeastern Pacific, operations will extend westward as far as Adak in the mid-Aleutians. The distribution of maturing Bristol Bay sockeye salmon will be investigated near the Tripartite Convention (Canada, Japan, U.S.) abstention line at 175° W.--before Japanese fishing begins in the spring.

Data collected by NMFS biologists will identify catch by species for each mesh size, and for length and weight of the salmon. Scale samples will be collected. Pituitary and blood samples will be used for racial and maturation studies. Frozen whole salmon will be returned to the NMFS Seattle laboratory for additional studies.

--Robert R. French
NMFS Biological Laboratory
Seattle, Washington

1970 OREGON COHO CATCH WAS WEIGHT RECORD

In 1970, Oregon troll salmon fishermen landed almost one million coho weighing 8.7 million pounds, a single-season record, reports Oregon Fish Commission. Although more fish were caught in 1967, their total weight was below 1970 catch.

Trollers also had a better-than-average chinook catch of 1.9 million pounds worth $5.9 million.

Over 50% of Hatchery Origin

Fish Commission studies in 1969 showed that over 50% of coho caught in Oregon troll fishery were of hatchery origin. About 90% of these hatchery fish came from Oregon, Washington, and Federal hatcheries on Columbia River; the remainder came mostly from Oregon's coastal river hatcheries.

The high percentage of hatchery-reared coho caught by Oregon trollers in 1970 reflects increasing success of hatchery programs, the Fish Commission states. The 1970 returns of jack coho salmon to Columbia River hatcheries indicate 1971 coho season will be another good one.

ANCHOVY FISHERY PASSES MIDPOINT TOWARD QUOTA

About 15,000 tons of anchovy were delivered to Terminal Island reduction plants during Dec. 1970 by the southern California anchovy mackerel fleet. Fishing was mostly good, but much fishing effort was lost because of storms off California and the holiday season.

Landings through Dec. 1970 were 58,884 tons--about 54% of 110,000-ton quota for season ending May 15, 1971.

MERCURY RESIDUES SHARPLY AFFECT U.S. IMPORTS FROM JAPAN

The U.S. Food and Drug Administration's findings of high mercury residues in seafoods have seriously affected U.S. imports from Japan and other suppliers, reports NMFS Terminal Island, Calif.

When FDA acted to remove all contaminated canned tuna from market, U.S. West Coast and Puerto Rican tuna packers stopped importing it. This virtually ended frozen-tuna purchases from Japan, South Korea, and Taiwan.

The Federation of Japan Tuna Fisheries Cooperative Associations began to buy and store tuna catches (at first, albacore) returned to Japan until mercury problem is solved.

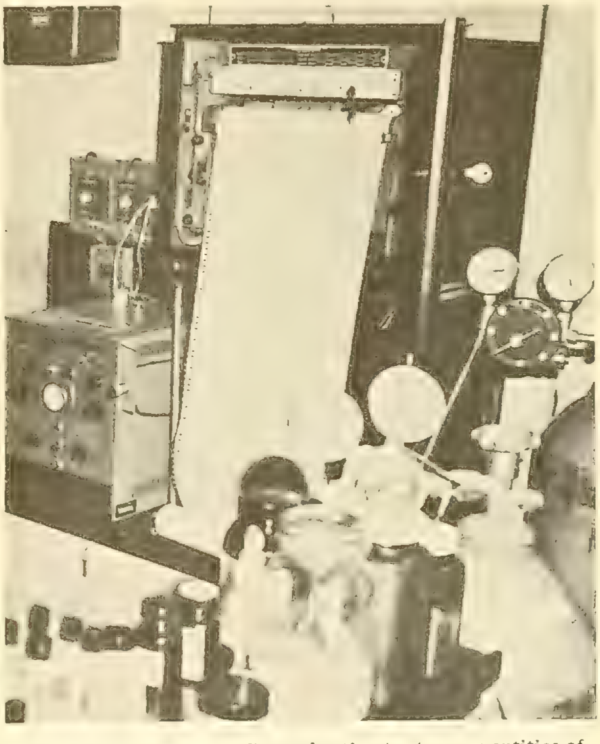
Swordfish Steaks Recalled

FDA then began large-scale recall of swordfish steaks. This just about shut door to shipments from Japan, a major supplier.

DDT LEVEL INCREASES IN LANTERNFISH

Lanternfish, or myctophids, are perhaps the most widely distributed fish throughout the oceans of the world. They are the principal forage fish of other species. Since CalCOFI cruises began in 1949, they have been caught often in night plankton tows and by dip-netting.

In recent months, NMFS has run a few of them through the gas chromatograph for DDT analysis. Biologists say these fish go through digestion, separation, and clean-up procedures a little better than other elements of plankton; also, they tend to have higher values of DDT if the pesticide is present.



Gas chromatograph identifies and estimates trace quantities of pesticides--as small as parts per trillion.

Results of Analysis

The results show that lanternfish taken in 1970 from about same area off southern California have high values; the values for these fish taken in 1950 were zero.

Available also for comparison with rest of plankton samples are lanternfish taken from frozen plankton samples.

ALASKA

1971 DROP IN ALASKAN SALMON PREDICTED

Alaska's 1971 salmon harvest will drop to about 41.5 million fish--20% below the 1960-69 annual average of 51 million fish and about the same as 1950-59 average of 41 million. This was predicted by the Alaska Department of Fish and Game.

By statistical region, biologists are predicting a catch of 7.85 million salmon in southeast Alaska, 21.69 million in central Alaska, and 11.92 million in western Alaska, which includes Bristol Bay.

Biologists Optimistic

However, biologists remain optimistic about the future of Alaska's salmon fisheries. They cite rapid recovery of important salmon-producing areas in Prince William Sound hit hard by 1964 earthquake, and increasing trends in recent odd-year pink salmon runs in southeastern and Kodiak fisheries. Another major factor is good escapements in Kvichak River in 1969 and 1970. This reflects Fish and Game's management strategy to return major Bristol Bay sockeye fishery to pattern of two or three good years in every five-year cycle, rather than a single good year per cycle.

INDUSTRY SUGGESTS SHRIMP QUOTA FOR KODIAK

Processors and fishermen believe that Kodiak-area production of pink shrimp may exceed 100 million pounds in 1971, especially if plans to increase processing capability at Kodiak are carried out. This was reported by NMFS Juneau. Besides the four plants now processing shrimp, four others are tooling up. Around 20 peeling machines are expected to be added to the present 18.

Quota Recommended

The Kodiak Advisory Committee, concerned about overfishing, has recommended that the Alaska Department of Fish and Game establish a quota of 50 to 60 million pounds for shrimp trawled from the three major Kodiak fishing areas. The committee hopes this would encourage fishing on grounds not now fished much.

LIVE ALASKA CRABS FLOW STEADILY TO HAWAII

Shipments of live Dungeness crabs from Homer, Alaska, have steadied at about 4,000 pounds a week. About half is shipped to Honolulu, the remainder to Portland, Oregon. A test shipment of live crabs from Anchorage to Honolulu via Los Angeles soon will be made to meet request of Hawaiian brokerage firm. Its purpose is to see if shipments can arrive mid-week in Honolulu.

SALMON ROE MARKET IS EXPANDING

Japanese demand is stimulating production of cured Alaska salmon roe. In 1967, Alaska produced 3,000 tons. Preliminary 1970 estimates indicate production between 5,700 and 5,800 tons, almost double 1967 figure.

The increase has been accompanied by greater Japanese acceptance. Roe produced during past season was considered by Japanese comparable in quality to that produced on Japanese motherships.

Salmon roe being processed at an Anchorage, Alaska, cannery. (BCF-Alaska photo: J. M. Olson)

PACIFIC WHALE WATCHERS ARE AT THEIR POSTS

The annual migration of the gray whales is under full steam. The 6,000-mile trip reaches from the Arctic Ocean and Bering Sea to the warm lagoons along the Baja California coast of Mexico. There, the whales mate and calve.

In December, January, and February, the movement of whales southward along the California coast attracts many watchers. The whales' closest approach to shore is off the headland at San Diego's Point Loma--and a little past the kelp beds at nearby La Jolla.

Fig. 1 - Spouting whales.

And, each year, about 350,000 persons watch the spouting and cavorting whales from a reviewing station of the National Park Service at Point Loma's Cabrillo Monument. Thousands of other whale watchers follow the migrations in excursion and private boats.

Going & Returning Whales Meet

The procession of whales will continue until late February or early March. At that time, whales that started their trips late--many of them mothers with recently weaned calves--will encounter the first returnees from sheltered inlets on Mexico's coast.

Whales usually spend 2 months at their mating and calving grounds. The 12,000-mile round trip takes 5-6 months. Average speed of a whale is 4 knots; a day's travel covers about 40 miles.

Recover from Near-Extinction

The gray whale was almost extinct before a 1937 international convention outlawed killing it. The herd increased steadily from that time until the present 8,000-10,000 head. This is estimated to be about 20% of the number that existed 100 years ago--when California's great whale slaughter began.

Fig. 2 - Spectators at whale watching station at NPS Point Loma's Cabrillo Monument. (Photos: National Park Service)

Marine biologists believe the gray whales have become more wary. They stay farther from shore to avoid humans. When they begin to return in late February, they will increase their distance from shore to protect their young.

Move Farther South

For years, the main destination of the whales has been Scammons lagoon, 325 miles south of San Diego on the Pacific coast of Baja California. In the last few years, however, as more people have moved into this area, the whales have moved farther south.

WATER POLLUTION KILLED 41 MILLION FISH IN 1969

Water pollution killed an estimated 41 million fish in 45 States in 1969, announced William D. Ruckelshaus, Administrator of the Environmental Protection Agency (EPA), in releasing the 10th annual fish-kill report in January.

The report was prepared by EPA's Water Quality Office (formerly Federal Water Quality Administration) in cooperation with the reporting States.

The 1969 fatalities were an increase of 170% over about 15 million fish that died in 42 States during 1968.

Ruckelshaus said: "These figures point out quite strongly the need for stricter safeguards to keep dangerous and hazardous materials out of the Nation's rivers, lakes, and streams."

Fish-kill census-taking began in June 1960. Since then, 144.6 million fish have been reported killed in more than 4,200 separate incidents. The record increase reported in 1969 can be connected partly to greater State cooperation, "to improved reporting practices, to greater public attention to fish kills, and to an unusually large single kill."

Industry Most Responsible

The largest single pollution-caused fish kill reported was 26.5 million fish in Lake Thonotosassa at Plant City, Florida. For 15 years before the kill, effluent from industrial and municipal sewage treatment had entered the lake untreated. Nutrients in the wastes reduced oxygen in January 1969 to level that resulted in death.

Fig. 1 - Pensacola, Florida: State Marine Patrol boat cruising through millions of dead menhaden in early Sept. 1970, after one of the Escambia Bay's biggest fishkills. It was 31st major fishkill reported in the Bay in 1970 (21 kills in 1969). The officer described scene as looking "like snow." The kill was caused by deoxygenation of the water; its victims were mostly 6-inch menhaden.
(Photo: Mike Albertson, Pensacola (Fla.) Journal)

Fig. 2 - The bank of an Illinois stream carpeted with victims of a large fishkill in August 1967. Carp and other "rough" species were among victims. (Water Quality Office, EPA)

In 1969, industrial operations produced the highest number of incidents and fish mortalities: 199 cases of industrial pollution resulting in 28.9 million dead fish. Municipal pollution, which had killed most of the fish in 1968, 7 million, killed the fewest in 1969--1.2 million.

Only two States--Nevada and North Dakota--reported no fish kills. There were no reports from Maryland and Mississippi.

Preparing the Reports

The annual fish-kill reports are received from cooperating State fish and game and pollution-control agencies. The reports are prepared in cooperation with Interior Department's Bureau of Sport Fisheries and Wildlife.

Copies of "1969 Fish Kills" may be purchased for 20 cents each from Superintendent of Documents, Washington, D. C. 20402.

WATER-QUALITY DROP IN UPPER GREAT LAKES THREATENS NATIVE FISH

The continuing deterioration of water quality in the upper Great Lakes is the greatest threat to replenishment of sturgeon, whitefish, lake herring, and other native fish, Stanford H. Smith reported to the American Association for the Advancement of Science in Chicago on Dec. 28, 1970.

Smith is associated with the Great Lakes Fishery Laboratory, Bureau of Sport Fisheries and Wildlife, and with the University of Michigan.

If thermal and chemical pollution cannot be halted, he said, "the massive undertaking to restore the fishery productivity of the upper Great Lakes may, in the end, prove futile." Already, water contamination has reduced or eliminated native species in Lakes Erie and Ontario. Lakes Michigan, Huron, and Superior "could follow successively during the next few decades if appropriate corrective measures are not implemented expeditiously."

Reasons for Decline

Water contamination by the logging industry and intensive fishing during the late 1800s contributed to the steady decline in native fish populations in the upper Great Lakes. More recently, Smith added, the increase of alewives, a species incompatible with the native fish, has led to "fluctuating fishery productivity."

Smith explained: "The alewife is wide-ranging, dense-schooling and active-feeding--attributes that are essential for its survival in the ocean. In the confines of a large lake, however, it ranges widely and competes strongly for space and food with virtually all other species at various times of the year."

Fish & Fishermen Decline

Reduced fish productivity led to a 95% decrease in the number of commercial fishermen in the upper three lakes between 1885 and 1965.

The U.S. catch there declined less, from 44 to 40 million pounds. But the species caught in 1965 were mostly nonnative, low-value fish, such as alewives, carp, and smelt.

Cool, Clear Water Needed

Smith noted that native species in the upper lakes "thrive only in cool, clear water." Thermal and chemical wastes "can only make the lakes less favorable for them." Also significant is the fact that species that prefer the coldest temperature were the first to decline. "This relation may mean that factors contributing directly or indirectly to temperature increases are, in essence, pushing the lakes climatically southward. If not abated, such changes may push the lakes beyond the ecological zone in which the native species capable of maintaining stability and high productivity could thrive."

LUMMI INDIANS' AQUACULTURE PROJECT NEARS COMMERCIAL PRODUCTION

The Lummi Indians, who live near Bellingham, Washington, are progressing toward commercial aquaculture. During the past year, in the first phase of their project, they built four acres of research ponds to prove the project's feasibility. Now they are beginning the second phase--commercial production in a complex of ponds that will total 750 acres. On a long tidal flat, where two miles are exposed at low tide, they have begun to dike and flood the tidelands--and let the high tide change the water behind the dikes.

1970's Achievements

In March 1970, the Lummis introduced into the first ponds oyster seed attached to suspended shells. Fed on plankton that multiplied quickly in the sun-warmed waters behind the dikes, the oysters grew rapidly. By fall, some of the crop was ready for market, far ahead of conventionally grown oysters.

Sharing the ponds with the oysters were 4,000 of the famed super rainbow trout bred by Dr. Lauren Donaldson of the University of Washington. Trout that weighed only 10 to a pound when planted reached 5 pounds each by fall. Also, baitworms were harvested from the pond bottoms.

First Oyster Hatchery

In a separate area, the Lummis built the first oyster hatchery in the Pacific Northwest. They overcame substantial technical problems in raising oyster larvae that commercial growers import annually from Japan and Korea.

Much Interest & Support

This project, directed by Dr. Wallace G. Heath, has attracted wide interest and support. About $500,000 in Federal, state, and private financing went into the first phase. The Economic Development Administration of the Commerce Department has granted $1.5 million toward construction of the second phase. Also, the Oceanic Foundation of Hawaii, a nonprofit research organization, provided $100,000.

The Lummi Council estimates that aquaculture could create 500 new jobs within the next decade. Beyond this, the lessons learned will have wide application--in the U.S. and elsewhere. The Council feels that production of food from the sea will increase with the application of new knowledge of feeding, breeding and, possibly in time, the application of waste heat from thermal power plants.

COMMERCIAL AQUACULTURE IN NEW ENGLAND IS YEARS OFF

There is little chance that commercial aquaculture will become a significant part of the New England economy in the next 10 years, especially not in the northern section. But investment capital might be tempted if science and technology were applied to the culture of 'luxury seafood'--shrimp, lobster, oyster, salmon, and trout.

This was the consensus of the 80 persons representing industry, government, and universities who, in Oct. 1970, looked critically at present and potential aquaculture in New England. The 3-day meeting, held at the University of New Hampshire, was sponsored by the Research Institute of the Gulf of Maine (TRIGOM), a group of Maine universities, and funded by New England Regional Commission. The meeting was reported by the New England Marine Resources Program in Dec. 1970.

What They Discussed

The participants acknowledged rapid developments in aquafarming methods. They noted that supplies of luxury stocks from natural sources have been erratic. Major firms working to achieve commercial aquafarming include: Armour, Corn Products, Co., Ralston Purina, Monsanto, United Fruit, Inmont, International Paper, and Minnesota Mining and Manufacturing. The work is not going on in New England.

How Nova Scotian Firm Operates

P. E. Cavanagh, the engineer-head of Sea Pool Fisheries, Lake Charlotte, Nova Scotia, said that already he is looking forward to annual sales of 40 to 50 million pounds of fresh salmon and trout grown in controlled aquaculture. His sales profits run 30%. A Montreal hotel has a standing weekly order for 5,000 pounds of fresh salmon and trout.

Sea Pool uses "closed-cycle, temperature-controlled rearing systems for culture of all the life stages of trout and salmon. Facilities include pools that can be filled with sea-water, surface fresh water, spring water, or any combination of the three."

Water is aerated continuously. Air-lift pumps recirculate it through limestone filters. When necessary, heat is added to the water from waste heat of an oil-fired power plant.

"The rearing pools allow for conservation of water, removal of organic wastes (particularly the nitrogenous ones), lower heating costs, and make possible more efficient general control of the environment."

Cavanagh said operations on land eliminate many socio-legal problems because the facilities "don't get in the way of other people."

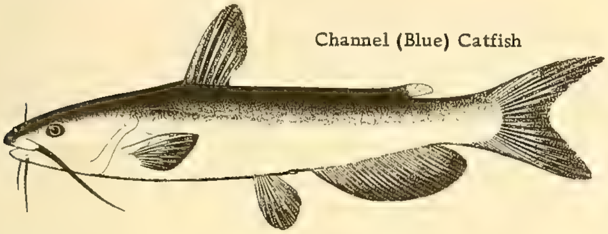
He had considered an aquacultural enterprise along U. S. east coast. But a review of water data, especially temperatures, ended the idea.

Species Evaluated for Culture

Thomas A. Gaucher, a natural resources consultant, chaired the conference's panel on technology. His group evaluated some species as possibilities for culture in New England.

The species were grouped according to present technical capability:

• Catfish, oysters, and salmonids (trout and salmon): There is advanced or adequate technology to culture all life stages. Commercial operations exist.



Channel (Blue) Catfish

• Scallop, mussel, prawn, and shrimp: There is advanced or adequate technological development, but species depend on nature for some life stages. Some commercial activity exists.

Shrimp

• Pompano, spiny lobster, American lobster, abalone, plaice, sole, and turbot: These require advanced technological development and some basic biological development.

• Barnacle, sea urchin, bait worm, seaweed, crab, conch, and tuna: Require technical development from a more basic standpoint. Also, basic biological work needed before decisions can be made on suitability for commercial production.

The most promising candidates for New England cultivation include: salmonid, bay scallop, mussel, oyster, quahog, and freshwater prawns.

Dr. Gaucher said aquafarming can be classified as 'extensive' and 'intensive':

• "Extensive cultivation normally involves large areas, low management, low capital cost, low operating cost, and low yield on a unit area basis." Examples would include coastal embayments, sluggish ponds, and open sea culture.

• "Intensive cultivation generally utilizes small production units, intensive management, dense stocking, force feeding, and stock selection and manipulation." This involves a "high capital cost, high operating cost, and produces a high yield per unit area." Examples include "raceway culture, lentic ponds, power plant effluents, rivers, some intertidal sea locks, zones of upwelling, and coastal embayments with high tidal exchange."

Intensive Approach More Promising

The intensive approach likely would yield best results in early aquaculture progress in New England, Dr. Gaucher said. This is because method can minimize dependence on nature. So uncertainties and risks would be reduced--and correspondingly, system's "reliability, output, and profit potential" would be increased.

GLOUCESTER FISHERMEN AIDED BY WOMEN'S GROUP

The women of Gloucester, Mass., one of America's oldest ports, have organized to help their fishermen kin. More than 150 wives, widows, and daughters founded the United Fishermen's Wives Organization of Gloucester (UFWG) over a year ago to speak for fishermen. UFWG then formed a fishing cooperative designed to set fair prices for fish from member boats, reports 'New England Marine Resources Information'.

The group has incorporated as Gloucester Fresh Fish, Inc., and is trying to raise $300,000 to do its job.

Industry Decline

UFWG secretary, Mrs. Grace Parsons, says there are never fewer than 1,200 unemployed in Gloucester, population 27,000. She claims unemployment is tied to decline of fishing industry.

She explains why her group is working for the rebirth of the industry: "In 1966, the industry was still the third largest employer in the city, paid the third highest wages, offered tourist appeal, and calculations showed that every two jobs in fishing created one job in other activities."

Mrs. Josephine DiLiberti, new group president, emphasizes the human and moral elements motivating their work--"the indissoluble ties of fishing with roots and tradition of Gloucester, whose natural harbor attracted the English, Portuguese and Italians from continental shores."

She adds: "It's disheartening, discouraging and dislocating to see the fishermen put in long hours and hard work for pay that can't support them or their families." Mrs. DiLiberti cites haddock selling at $1.39 per pound retail, while the fishermen get only 25 cents. "We'll be the fish dealer now under the new cooperative and pay the fishermen a higher, fairer wage."

Seeks to Increase Fleet

A main objective of the coop is to enable fishermen to buy new vessels or enlarge fleet through coop loans.

The coop hopes to cut sharply the fishermen's insurance fees, which now are 25% of a year's expenses. It will regulate its own members and so lessen disputes that now exist between fishermen and insurance agency. The former complain of "blackballing"; the latter of "faulty claims".

1971 Building Plans

Construction of the coop will begin in spring 1971, says Mrs. Parsons. A 40 by 60 foot, prefabricated steel structure will be built at the end of a filled wharf in the downtown area. The space was made available through urban renewal. More than 20 boats can be docked at the wharf. The coop will lease the wharf for $180 per month, "with option to buy".

Processing Unit Later

At first, the coop will be fish dealer only. Then a processing unit will be put in. Eventually, buying, selling, and distributing will be handled completely by coop.

'GLOMAR CHALLENGER' REPLACES DRILL BIT 3 MILES DOWN

The drilling research vessel 'Glomar Challenger', operating in water 13,000 feet deep in the Caribbean Sea's Venezuelan Basin, recently replaced a worn drill bit. The expedition members achieved this after drilling 2,300 feet, reentering the same 5-inch bore hole at the sea bottom with a more than 3-mile drill string. They then drilled 200 feet more to recover chert, hard limestone, and crystalline rocks for the first time.

The re-entry technique of National Science Foundation-sponsored Deep Sea Drilling Project is used to recover ancient deep-sea sediment. The success was announced by scientists and engineers of Scripps Institution of Oceanography, University of California, San Diego.

This was the second re-entry achieved by the Deep Sea Drilling Project. The first was off the U. S. East Coast on June 14, 1970, in 10,000 feet of water.

The Second Re-Entry

The Project scientists have recognized that many scientific objectives lay beyond the reach of the drill string because even the sturdiest bits would wear out in resistant areas. But with the first re-entry achieved, they chose a site near which previous drilling had to be aborted: in the Caribbean Sea, at 15°07' North Latitude and 69°23' West Longitude, about half way between Venezuela and Puerto Rico.

There, a beacon was dropped to the ocean floor as a reference point for maintaining position while drilling. Then 160 feet of $13\frac{3}{8}$-inch diameter casing were attached to a 60° cone 16 feet in diameter at top, 13 feet high, and with 3 acoustic reflectors spaced equidistantly around its top. The cone and casing were attached, in turn, to the drill pipe with the core bit; the entire assembly was lowered to sea floor. The casing was pressed into the sediment leaving the cone at sea floor. Then the drill pipe was released mechanically from the cone and casing assembly. A normal drilling-and-coring operation was conducted through soft sediments to 1,300 feet below the sea floor, where harder rocks, 45 million year old, were encountered.

After more drilling, the tungsten carbide bit was spent. It was withdrawn from the limestone and chert at 2,300 feet, and pulled back to derrick floor. A new core bit was installed on the drill pipe at derrick floor and lowered to within 30 feet of ocean floor. A transducer, which emits and receives a high-frequency sound, was lowered on conductor cable through the 5-inch-diameter drill pipe to extend 6 inches below core bit. The transducer scanned the ocean floor with 360° rotation and emitted a high-frequency sonic beam, which the cone reflected back. The cone was first located 300 feet from the drill pipe. As the scanner sent out sound pulses and listened for echoes, the engineers on ship's bridge directed the hunt on an illuminated screen, like that used with a radar set. The 10,500-ton vessel was moved toward a series of reflectors that characterized the cone, a very precise maneuver.

Drill Pipe Lowered

When the Glomar Challenger was centered over the cone, the drill pipe was lowered. At first the expedition members thought it had re-entered the old hole. However, after drilling 300 feet, they concluded it had missed the re-entry cone. A new hole was drilled. A 30-foot core confirmed their conclusion.

The core bit and drill pipe again were positioned 20 feet above sea floor and sonic transducer lowered into place. The re-entry cone was located about 90 feet from drill string, and the vessel again was maneuvered directly above cone. This time the drill string was lowered to make a successful re-entry. As the core barrels were opened on ship to expose their long columns of undisturbed rocks, they were examined immediately by scientists. The tiny fossils were examined under microscopes to answer immediately the all-important question of age.

Value of Achievement

Dr. N. T. Edgar of Scripps and J. B. Saunders of Texaco Trinidad, co-chief scientists, said: "The whole column of rocks discovered is of prime interest, but the presence of basalt at the bottom of the hole can be considered especially so. The existence of such relatively young rock of this type formed by melting may cause geologists to revise their theories as to the age of the Caribbean Sea."

The Project scientists believe that reentry is now a workable tool. It will be of great value to the Deep Sea Drilling Project and for the economic exploration of the deep ocean floor. With improved drilling bits and capability to change them, there is a much better chance of drilling deep holes where the need for information is greatest--in the ocean basins.

15 U.S. SHIPS STUDY DEEP OCEAN & COASTAL WATERS

About 880 scientists, technicians, and crewmen aboard 15 Commerce Department ships have begun a nearly year-long study of the waters that splash the U.S. shores.

They will sail from Alaska to Hawaii and the South Seas, traverse the Atlantic to Africa, to the Caribbean and Gulf of Mexico, and up and down the Atlantic and Pacific coasts.

"They will probe the oceans, including the land beneath and the air above, the coastal waters and estuaries of the United States, the submerged continental shelves, the wrecks that dot America's shores and the treacherous currents that endanger seamen and their craft."

Their Missions

The scientists will study the mysterious internal wave undulating below the sea's surface. They will probe, too, the mountains, ranges, canyons, and massive fractures in the earth at the sea bottom, and the unseen ocean 'rivers'. They will seek new evidence of the movement of continents and the spreading of the sea floor.

While the larger vessels are conducting these activities, the smaller ones will conduct "marine charting surveys, measuring the currents along the coasts and in estuaries, bays, and harbors and scouring the coastal sea lanes for submerged wrecks, pilings, abandoned oil derricks, and other dangers to sea commerce and recreational boating."

PLAN CONTINENTAL-SHELF LAB OFF TEXAS

A 13-member committee is planning a continental-shelf laboratory off Texas.

The committee, led by Dr. W. H. Clayton, Texas A&M, is sponsored jointly by Texas A&M and the University of Texas Medical Branch at Galveston. Dr. Clayton said its primary concern will be to determine the benefits to the state from the laboratory complex. "Development of a continental shelf laboratory has been a goal of Texas A&M since the publication of the President's Commission on Marine Resources and Engineering Development report in 1969. The Galveston Chamber of Commerce has stimulated recent activity through its long-range planning for development of the State's marine potential and through its plans for a 'Texas Tektite' program."

Many Groups Involved

The lab would support a broad program. Most of the research would center on ocean and environmental science, including pollution and water-quality studies.

About 30 percent of the program would deal with man-in-the-sea and biomedical research. Texas educational and research institutions, supported by industry and government, would cooperate in the lab's efforts.

Feasibility Study

Texas A&M recently published a preliminary feasibility study of a possible site for an offshore lab through its NOAA-sponsored Sea Grant Program. A permanent lab in the Flower Gardens coral reef area, 110 miles off Galveston, was called technically feasible. The report stated that a permanent lab would offer unique research opportunities for a

short time; however, it questioned whether scientific results can justify high costs of a permanent lab on one site. Initial costs would be $3-4 million.

Dr. Clayton explained: "One of the tasks of the study committee will be to explore the possibilities of using platforms, submersibles, habitats, and such facilities as a floating semi-submerged instrument platform patterned after the Navy's FLIP ship. It is technically possible to construct a facility in the Flower Gardens area. We simply must ask ourselves what kind of facility we need and what we hope to accomplish through the use of it."

SURVEYING THE WORLD'S CORAL REEFS

"Nowhere in the ocean are divers provided a greater panorama of underwater life than around the world's coral reefs," states 'Sea Grant 70's', published by Texas A & M University. Divers from the University of Hawaii and Texas A & M are conducting Sea Grant studies in these coral communities.

Seven Sea Grant researchers are diving in the Kaneohe Bay Reef area off Oahu to learn more about the dynamics of reef growth. The researchers include oceanographers, zoologists, geologists, and botanists. The results will help in management and stimulation of reefs affected by man's activities or natural disasters.

What Researchers Are Doing

The diver-scientists are transplanting corals and other reef organisms to determine which are most adaptable to unfavorable conditions, such as major sewer outfalls that occur at the reef's southern end. They will try to regenerate large reef areas killed by pollutants, fresh water, and other causes in Hawaii and the trust territories.

In Gulf of Mexico

At Texas A & M, Sea Grant supports research in Gulf of Mexico's Flower Gardens reef area, about 125 miles off Texas. Diver-scientists are conducting biological, acoustical, engineering, and geological research.

A feasibility study is underway to determine whether a permanent underwater research laboratory should be established in the area. The researchers are studying economic potential of sediment beds around the reef, which caps a large salt dome; testing durability of various substances; and sampling soil.

Twelve graduate students in biological and geological oceanography made an underwater field trip to coral reefs off Mexico's Yucatan Peninsula.

RECOVERING UNDERSEA TREASURES

Until the last few years, underwater salvage techniques remained much the same as those used in 1939 to raise the U.S. submarine 'Squalus' from 240 feet, reports 'Sea Grant 70's'.

Conventional methods have used dewatering by pumps, dewatering by air, and lifting devices. Polystyrene and polyurethane foams to obtain the desired buoyancy have become increasingly popular because these are relatively low-cost materials and can be easily transported by air.

Problems of Salvaging

Still, problems of salvaging need further investigation--such as breakout, which is freeing objects from ocean bottom. To this must be added expected hazards of ocean; weather deterioration during a dive; currents providing unfavorable drift rates; unstable bottom sediments, and many more.

Treasure lost in 1553 when a Spanish fleet carrying gold and silver sank off Padre Island near Texas coast was the object of search by three Texas A & M divers.

The divers used magnetometer readings to indicate metallic or rock interruptions on Gulf bottom. These were investigated. When wreckage was found, shore crews took compass readings to record exact location. All artifacts were turned over to the state committee. The project's primary function was to mark the wreckage to prevent plundering and illegal recovery.

8 UNIVERSITIES BUY THEIR OCEAN LAB SITE ON L.I.'s EASTERN TIP

The New York Ocean Science Laboratory--an 8-school consortium--has bought a 36-acre tract in Montauk, on Long Island's eastern tip, for a waterfront campus and center. The lab had leased part of the property since June 1969.

The lab is operated by colleges and universities in the N.Y. metropolitan area. It is conducting 7 research projects on the marine environment.

The schools are: Adelphi University, Fordham University, Hofsta University, Long Island University, the New York Institute of Technology, New York University, St. John's University, and the State University of New York.

Step Up Program

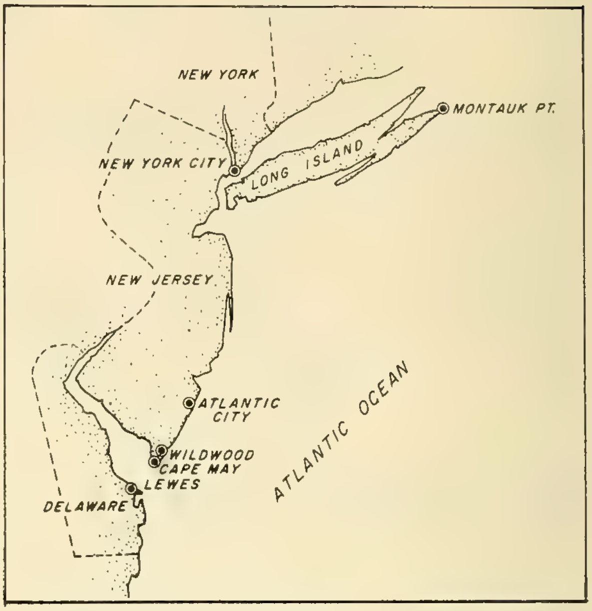
Dr. John C. Baiardi, the lab director, said the acquisition of property will "enable the laboratory to step up its renovation and expansion program."

"We can now intensify our program to recruit qualified professionals so we can better address ourselves to the problems of Long Island waters and to the preservation of our overall marine environment."

To Make Huge Model

One of the lab's major undertakings, to begin this year, is construction of a $4-million hydraulic model of Long Island and its waters.

The model will be built in stages. The first will be the Great South Bay. Each will be functional when completed. The model will be housed in a former hangar 600 by 200 feet.



Almost any condition of currents, tides, storms, erosion, and water pollution could be produced in the model, according to Dr. Baiardi. The model of the whole island is scheduled to be completed by 1975.

Finfish & Invertebrate Lab

Dr. Baiardi said that the lab's scientific and technical staff would quadruple in 1971 to about 50.

The first project will be to convert one of the 10 buildings to a finfish and invertebrate lab. Until now, the lab has worked with movable equipment on 30,000 square feet of office space.

With the other buildings, the lab will have 300,000 square feet of space available. There are 5 railroad sidings and a 400-foot dock with a 40-foot water depth at low tide. The lab moors there the 'R.V. Kyma', a chartered research vessel.

VIMS DEVELOPS COASTAL ENVIRONMENTAL & ENGINEERING DATA CENTER

Scientists at the Virginia Institute of Marine Science (VIMS), Gloucester Point, are developing a comprehensive data system to provide industry and government with the most up-to-date information on oceanography of Chesapeake Bay and Virginia coastal waters. This was announced by Dr. William J. Hargis Jr., director.

Dr. Hargis explained: "The data system, called Marine Environment and Resources Research and Management System (MERRMS), will be a depository whereby all available information about hydrography, chemistry, geology, and biology of the Chesapeake Bay area can be stored, retrieved and utilized by planners, engineers and management agencies." A unique feature will be the visual presentation of information to enable viewers to assess quickly "many relevant factors operating on a given environment."

MERRMS will provide management advice on "estuarine and coastal problems involving wetland use, shoreline and beach erosion, sedimentation, pollution, dredging, and fisheries to state and federal agencies having responsibilities in these areas."

Remote Sensing Unit

Integrated with MERRMS will be a Remote Sensing Unit to provide monitoring of the natural or original position ('in situ'). VIMS will continue to use traditional aerial surveillance and photography. It will use, too, newer techniques of aerial sensing developed by NASA and the Department of Defense. Satellite sensing also will be evaluated and used "where applicable."

Remote sensing from airplanes and satellites records much detail from over a large land or water surface at relatively low cost. The usefulness of the data recorded, however, depends on trained personnel to recognize specific areas or conditions recorded as photographs, or in other ways, as the areas or conditions they have seen close up. 'In situ' remote sensing often is necessary to evaluate aerial and satellite observations, provide "ground truth", and to understand in detail the condition of the environments and resources involved.

Data Needed

Hargis emphasized that all those responsible for cleaning up pollution and protecting coastal zones from degradation must have much information available. "Neither industrial engineers nor governmental management agencies can regulate resource use without a fund of scientific and engineering knowledge to draw on, and the pressures of the times demand that this knowledge be available to them in detail as well as in context of comprehensive overview."

Hargis believes MERRMS will become prototype for attacking problems of coastal environments and resources--in Chesapeake, mid-Atlantic, or along coasts:

"In the United States, concern is so strong for protecting resources of the ocean coast, bays and estuaries that a National Coastal Zone Program is developing at the federal level. The over 30 maritime states, Commonwealths and Territories are making strong efforts to improve management of and research on coastal resources.

"From Maine to Florida on the Atlantic, from Florida to Texas on the Gulf, from California to Washington and Alaska on the Paacific, and Hawaii in mid-Pacific--all these states are vigorously planning and conducting research looking to better utilization and conservation of coastal fisheries, wetlands, shorelines, bottoms and water. It is hoped that establishment of our data storage, retrieval and analysis system, MERRMS, will be Virginia's significant contribution to this effort."

Dr. Hargis believes the general public, fishermen, and those in seafood industries will benefit. "The Institute's own research programs will be improved."

NAVY SUCCEEDS IN GETTING OCEAN DATA VIA BUOY-SATELLITE HOOKUP

A free-floating, specially instrumented buoy, drifting off Virginia, recently dispatched data needed to understand surface current patterns to a solar-orbiting satellite. It was achieved on the first try by the U.S. Naval Oceanographic Office (NOO).

The satellite-acquired data were sent to scientists studying current patterns at NOO via NASA's Fairbanks, Alaska, command control station and the Goddard Space Flight Center in Greenbelt, Md. The data consisted of wind and temperature measurements, together with exact positions.

NOO's success has led its officials to think of launching two such buoys in Gulf Stream in 1972.

The Buoy

The 42-foot-long, 1,700-pound buoy is instrumented with wind and temperature sensors, data-recording electronics, and a sophisticated satellite communications system. It was set adrift in 50 minutes in relatively calm seas about 200 miles northeast of Cape Charles, Va., and 75 miles northwest of Gulf Stream by scientists aboard USNS 'Lynch', a small oceanographic research ship.

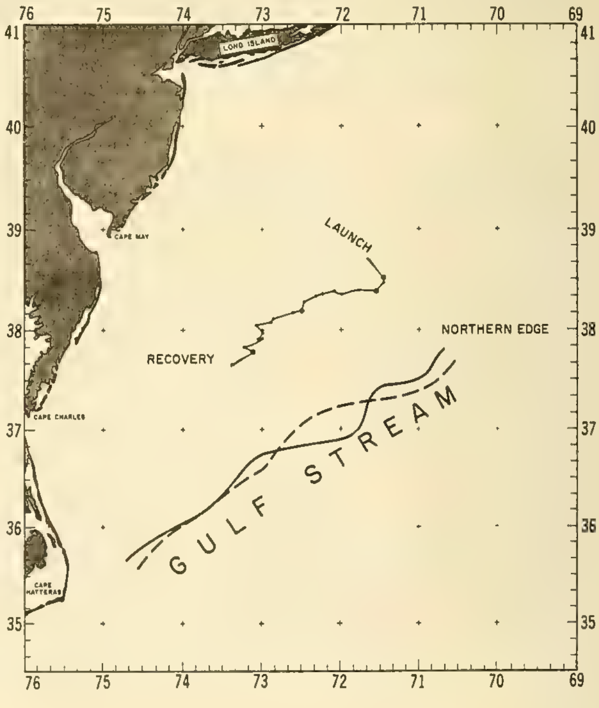
Coast Guardsmen aboard the USCG 'Evergreen' retrieved buoy 21 days later about 90 miles southwest of its launching site. This southwesterly drift "was more or less expected," according to Alton Crumpler, oceanographer. "All our historical data," he said, "pointed to this general flow, but the current carrying the buoy and its exact course were unknown. It may be part of a large gyre (a circular-moving current), which may, at some later point, merge with the northeastward-flowing Gulf Stream."

Study's Goal

The oceanographers are studying surface current patterns to understand ocean circulation worldwide. This could lead to mass water movement predictions that would facilitate ship routing for the Navy, U.S. Merchant Marine, and allied shipping interests.

Also, the predictions could help determine the movement of sea ice, icebergs, and oil spills--and help in rescue and salvage operations.

BUOY DRIFTS ON CURRENT--Scientist aboard USNS 'Lynch' watches specially instrumented buoy begin its drift off Virginia (above). Chart below shows how it moved in relation to coast and Gulf Stream. (U.S. Naval Oceanographic Office)



NAVY DEVELOPS DEEP-DIVING SYSTEM

The U.S. Navy has developed a deep-submergence system that will enable its divers to conduct rescue and salvage operations at 850 to 1,000 feet. The achievement comes after nearly 8 years of trouble-plagued efforts.

In the past, Navy divers were limited to about 300 feet for short periods by severe chilling and fatigue.

The new system, called Mark I, is markedly superior to the 'Man in the Sea' projects, the Navy says. The first Mark I will be based at Norfolk, Va.

The Mark I

Now, alternating 2-man teams of Navy divers can stay at 850 feet or below for up to 29 days. The new system opens Continental Shelf areas the world over to rescue and recovery operations.

The Mark I is designed to support 4 men: two 2-man teams each working 4-hour periods. This and decompression time after saturated dive total up to 29 days.

The heated divers' suits of Mark I and its undersea "landing capsule" use techniques borrowed from manned Apollo program.

Mark I operates from a mother ship that houses a 2-chamber decompression unit, mission control, communications, and the main life-support system.

Locked to top of large decompression chamber is a bulbous personnel transfer capsule, or elevator. It can handle 2 or 3 men. The capsule is detached from chamber--as lunar landing module is separated from Apollo command module--and lowered by winch and cable to desired depth.

The entire Mark I system can be transported anywhere aboard two C-141 cargo planes. It can be deployed quickly aboard any ship.

Decompression Chamber

The decompression chamber can accommodate 4 men. It contains food, water, beds, bath and toilet, and monitoring communications.

While one team works, the other--already conditioned to 850-foot depths--waits in chamber. When the first returns aboard transfer capsule, the second takes over.

Transfer Capsule

When transfer capsule with 2-3 divers reaches desired depth, divers don aquanaut suits. They leave through pressurized lock. This is a 100-foot umbilical cord linking them to capsule and providing life support and communications.

One diver, in his shirtsleeves, remains in capsule to monitor work and communicate with mother ship.

A constant check on divers' condition and progress is maintained by physicians and others on surface using space-type monitoring, including TV and telemetry.

DEAD MANGROVE LEAVES SUPPORT AQUATIC LIFE

Red mangroves--tropical trees that fringe South Florida's bays--have "immense value," reports the University of Miami's School of Marine and Atmospheric Sciences. ('South Florida's Mangrove-bordered Estuaries, Their Role in Sport and Commercial Fish Production'.) Much of the information in the 28-page bulletin is based on work of two graduates, Dr. Eric J. Heald and Dr. William E. Odum.

"Many persons consider estuaries and coastal marshes to be useless in their natural state," noted Dr. Richard G. Bader, Associate Dean. "They do not realize that these areas are important as havens and nurseries for over half of the harvest of fish and shellfish in the United States. In southern Florida, for example, the 700 square miles of mangroves bordering the shallows are inhabited by thirty or more popular species of commercial and sport fishes, the pink shrimp, and the blue crab."

Mangroves Linked to Valuable Catch

Dr. Bader added: "Decomposition of dead mangrove leaves that have fallen into the water results in a high-protein food for small marine animals, which are eaten by larger ones. In 1968, commercial landings of species linked to the mangrove food web yielded over 32 million pounds of shrimp worth $15.7 million; 3.7 million pounds of spotted seatrout worth $1 million; and 15 million pounds of blue crabs worth $1.2 million. Consideration should be given to the fact that nature's production of these resources is greatly decreased in an area where clearing, filling, or bulkheading destroys the mangroves."

Mangrove Study

Dr. Heald and Dr. Odum studied the red mangrove, Rhizophora mangle, and its role in food web of North River estuary of Everglades National Park. They found that only 5% of area's annual production of red mangrove leaves is consumed by land animals--while about 95% enters aquatic system.

Their work showed that decomposed mangrove leaf particles, detritus, transport energy in the food web. When dead leaves fall into water, they become hosts for certain bacteria and fungi. These microorganisms use the plant material as a place to live and to get nutrients; they have ability to absorb resistant plant substances, such as cellulose, and to decompose leaves.

Food Web

Also, one-celled animals (protozoans) feed on the bacteria. This creates a rich food complex of fungi, bacteria, protozoa, and detritus. Tiny crabs and amphipods ingest this complex, digest microorganisms off detritus particles, and release the indigestible plant cell walls into water as fecal material. Then, the detritus particles are recolonized by microorganisms and "repeat their role as carriers of nutrients."

Mangrove-leaf fall produces more than 3 tons (dry weight) of detritus per acre a year. When leaves are alive on trees, they contain about 6% protein, but this value increases up to 22% after detritus has been in the water a year. This does not mean, the researchers say, that the protein content of detritus itself has increased; it means that there is relatively more protein present on particle because it is being colonized by microorganisms rich in vitamins and protein. "A detritus-consumer will obtain more nutritive value, therefore, by eating 'aged' detritus particles because they are more heavily coated with microorganisms."

Detritus Important

Analyses of stomach contents of thousands of marine animals in North River estuary revealed they consume little phytoplankton and bottom-growing algae. Eighty to 90% of the diet of many crabs, worms, insect larvae, shrimp, and small forage fishes consists of mangrove detritus. Then these detritus consumers fall prey to more than 60 species of juvenile fishes, including tarpon, snook, gray snapper, sheepshead, red drum, spotted seatrout, crevalle jack, catfish, jewfish, menhaden, and striped mullet. Many of these fishes spend long periods in the estuary; others in surrounding coastal waters into which about 50% of yearly tonnage of detritus is transported. Here, as in estuary, it is eaten by lower animals in food web.

Pollutants in Estuaries

So many species depend on mangrove detritus as a source of nutrition that scientists are concerned about possible pollutants in estuaries. Pesticide residues can become adsorbed onto surface of detritus, or may be concentrated by bacteria, fungi, and protozoans living on particles. If crude oil is introduced into the water, it may form around particles and prevent microorganisms from colonizing them. Certain chemical pollutants could kill the microorganisms. Thermal pollution could produce undesirably low levels of dissolved oxygen in areas where water exchange is poor.

Sea Grant Program

The Sea Grant Program enables the University of Miami to disseminate scientific data to the public and to government officials responsible for decisions on environmental changes. Increasing population in south Florida makes certain changes inevitable. But if people become more concerned about the principles involved, the researchers hope, perhaps the modifications can be reduced.

Sea Grant information Bulletin #4, at $1, may be obtained from: Sea Grant Advisory Services, 10 Rickenbacker Causeway, Miami, Florida 33149.

NOAA AWARDS SEA GRANT TO STUDY SPONGES' ANTIBIOTIC SUBSTANCES

NOAA has awarded a Sea Grant to extract and test antibacterial agents from sponges. The $209,000, 3-year grant was awarded to New York Zoological Society's Osborn Laboratories of Marine Sciences.

Osborn scientists will attempt to isolate substances found in sponges that may have therapeutic value as antibiotics, antifungal agents, and metabolic inhibitors. Then the researchers will seek to determine chemical composition of these substances and to investigate their potential as therapeutic agents.

Scientific Studies Are Recent

Known and used by man for centuries, it is only recently that the sponges' biochemistry has been investigated. Mostly fresh-water forms easily maintained under laboratory conditions were studied.

The Osborn Laboratories of Marine Sciences are equipped with piped-in sea water. Its scientists have investigated systematically the extracts of many sponges from Jamaica and British Virgin Islands. Antibacterial substances were present in extracts from 23 of the 125 Jamaican species--and seem to indicate they are commonly found.

A Tunisian sponge trimmer.

In the Northeastern Gulf of Mexico —

HARVESTING COASTAL PELAGIC FISHES WITH ARTIFICIAL LIGHT & PURSE SEINE

Donald A. Wickham

Coastal pelagic fishes in the Gulf of Mexico represent a latent resource estimated at 4 million tons, a potential 8 times the present 500,000 tons (Bullis & Carpenter, 1968). These could be harvested economically with purse seines if supplemental methods, such as light attraction, were developed to create commercial aggregations in areas with fishable bottom. Experimental night-light purse seining revealed that fish could be attracted throughout the night, but that average catches were larger during the new moon.

Three species contributed 50% or more of total catch weight in 71% of experimental sets. Their potential was estimated the greatest among latent coastal pelagics. These were Spanish sardine, Sardinella anchovia; Atlantic thread herring, Opisthonema oglinum; and scaled sardine, Harengula pensacolae.

Nightly total catches from a light source, a single 1,000-watt underwater mercury vapor lamp, ranged from 500 pounds to over 6,000 pounds. The nightly average was 2,500 pounds. It indicates that artificial light can be developed for harvesting coastal pelagics.

Present production of coastal pelagics is based primarily on purse seining for menhaden, Brevoortia spp., for reduction to industrial products. There are indications the catch of B. patronus has reached or perhaps surpassed level of sustainable yield. At best, this species is only the third, and perhaps only fifth, most abundant coastal clupeid in Gulf. Stocks of thread herring, Opisthonema oglinum, alone have been estimated at about one million tons (Bullis and Thompson, 1967).

Butler reported in 1961 that the behavior of the herringlike coastal pelagics makes them difficult to capture with standard purse seines. At times, large schools divide rapidly into smaller groups that are extremely fast and difficult to encircle with a purse seine. Fuss and his colleagues reported in 1969 that the thread-herring fishery has been confined to a small area off Ft. Myers, Florida, in less than 10 fathoms. This is because of rough bottom conditions to north and south, and depth limitations of tom-weight purse seines prevents successful fishing. The feasibility of harvesting this resource economically with present methods has yet to be demonstrated.

Facilitating Economical Exploitation

Economical exploitation of coastal pelagic resource could be facilitated in two ways: by development of new fishing gear, or by introducing to purse-seine fishery supplemental methods capable of forming commercial-sized aggregations in areas with fishable bottom. In 1960, von Brandt reviewed methods

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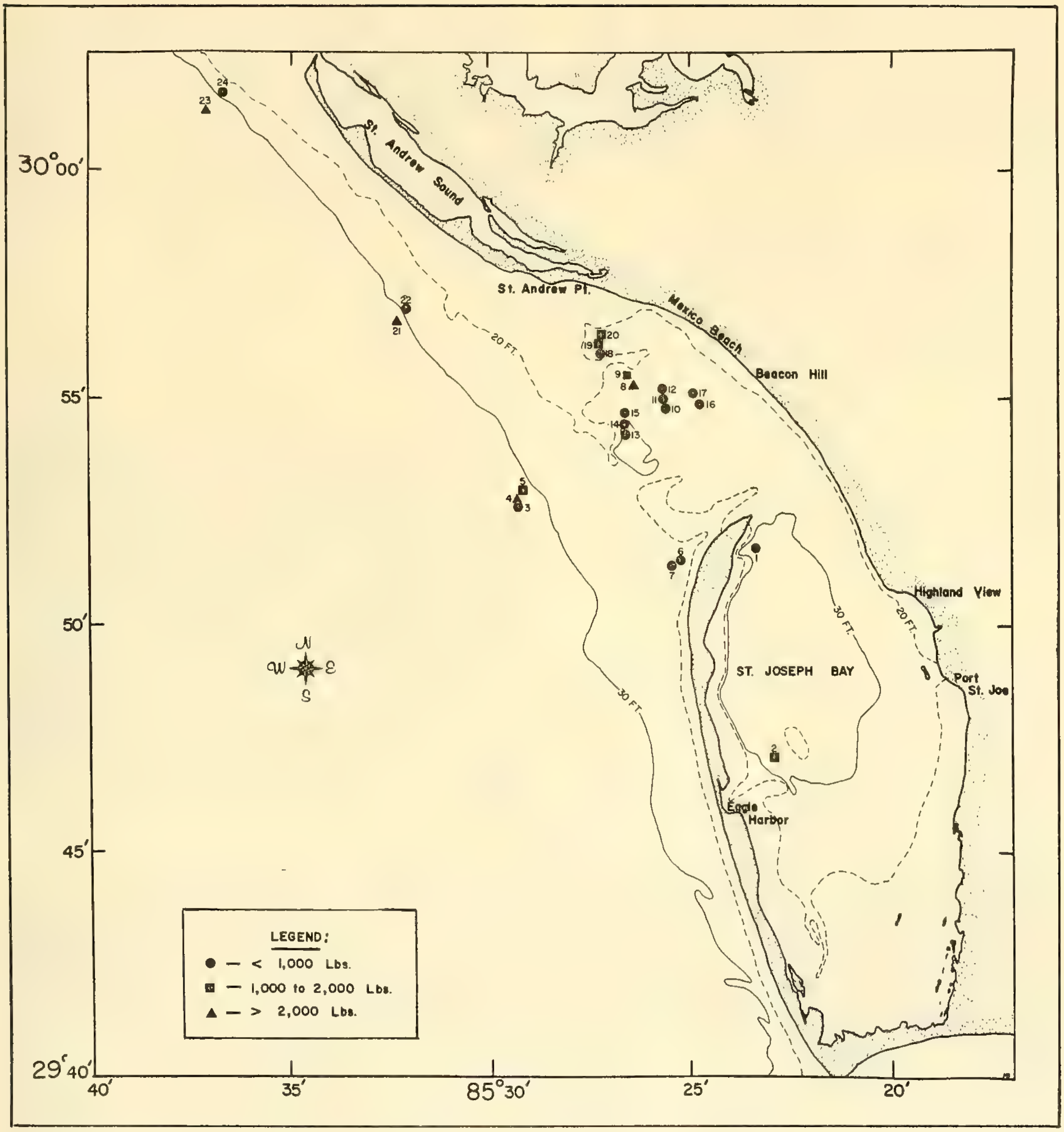

Fig. 1 - Location of night-lighting stations sampled by purse seine during Aug.-Sept. 1969. Sample numbers are beside each station. Legend is key to catch size.

of harvesting sardines and related species throughout the world. His findings revealed many types of nets used to catch fishes that have aggregated around artificial lights at night. Successful experiments using purse seines to capture herringlike fishes attracted to artificial lights have been reported by Gauthier (1969) in Canada and Ström (1969) in the Philippines.

On collecting trips in northeastern Gulf of Mexico, we used artificial lights and a 5-meter diameter lift net. We observed large concentrations of coastal pelagic fishes extending well beyond capture zone of this net. Although live samples were obtained for laboratory studies and qualitative identification, the lift net proved unsuitable for quantitative estimates of fish aggregations attracted to lights.

Purse-seine sets reported in this paper were made during August and September 1969 off Port St. Joe, Florida. They provided quantitative data for preliminary evaluation of feasibility of using artificial light to attract coastal pelagic fishes.

This preliminary study provided: (1) beginning of inventory of species that form commercial aggregations around artificial lights, and (2) initial step in quantitative evaluation of artificial light to aggregate commercial quantities of coastal pelagic fishes for harvesting in preselected areas. The fishing periods were also scheduled to provide data on (3) the effect of moon phase on size of aggregations formed by artificial light, and (4) the times for sets were preselected to provide data on intranight variability of effectiveness of artificial lights.

A. Experimental Fishing Methods

1. Objectives & Organization of Fishing Periods & Experimental Sets

Three periods during new and full moon were scheduled to provide preliminary indications of effects of lunar phase on aggregation effectiveness of artificial lights. Sets were made at about 3-hour intervals following sunset to assess intranight variability of attracting-characteristics of artificial lights.

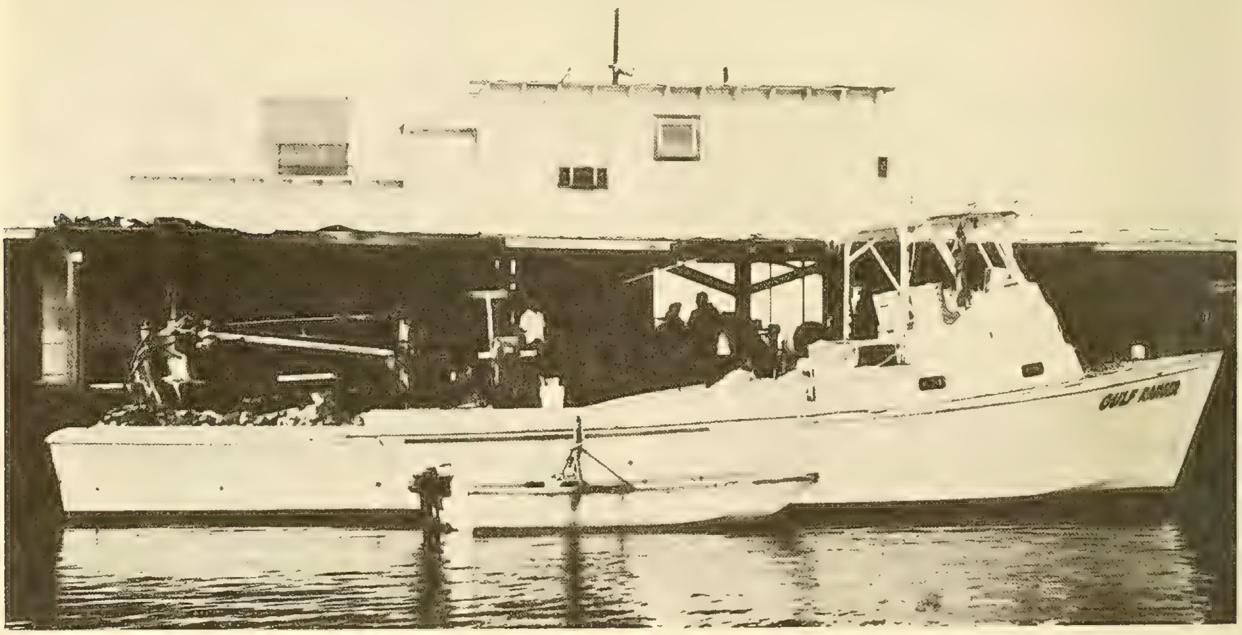

Fig. 2 - The chartered 49-foot, single-boat rig, bait purse seiner, 'Gulf Ranger'. The net skiff is tied alongside seiner.

2. Selection of Fishing Stations

The fishing area selected was along 30-foot contour across entrance to St. Joseph Bay. Stations were occupied whenever weather permitted. Considerable inclement weather was experienced during charter periods. Because light skiff was an open 16-foot outboard, most locations shown in Figure 1 were determined by wind direction and sea conditions.

3. Fishing & Experimental Equipment

The 'Gulf Ranger', a 49-foot, single-boat rig, bait purse seiner, was chartered (Figure 2). Its purse seine was a "tom-weight" type, 1,545 feet long and 71 feet deep, with $1\frac{1}{4}$-inch stretched mesh webbing. A 16-foot outboard served as skiff; attracting lamp (1,000-watt underwater mercury vapor) was deployed from it (Figure 3). Fish aggregations below light were monitored by echo sounder. The underwater lamp and echo-sounder transducer were mounted on a wooden depressor suspended beneath skiff during fishing. Power for lamp and echo sounder were supplied by a portable, gasoline-powered, 2.5 kilowatt, 115 volt A.C., generator mounted in skiff. Communications between skiff and purse seiner were maintained by portable FM radios.

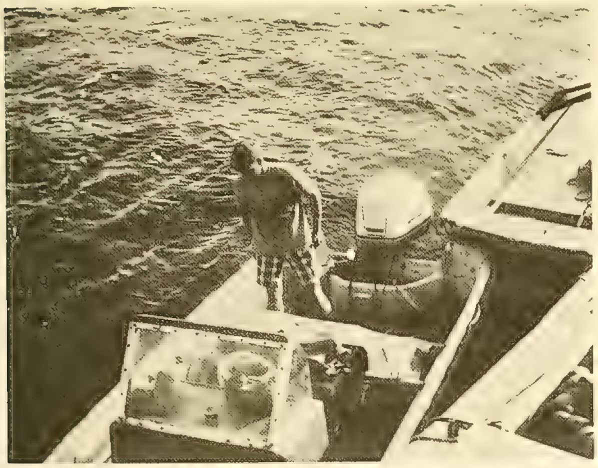

Fig. 3 - The 16-foot outboard used as a light skiff during study. The portable echo sounder is mounted across boat behind bench seat. The underwater light and echo-sounder transducer are mounted on wooden depressor lying in right hand corner of stern. The portable generator, not shown, was positioned in bow ahead of steering console.

4. Experimental Fishing & Sampling Procedure

The manned light skiff was anchored on station at night with light turned on (Figure 4). The seiner anchored nearby with its lights off. The seiner turned its lights on only after the net was pursed. When seiner began making a set, the light skiff anchor was pulled up. During pursing, the skiff would drift to corkline opposite net opening and remain inside net with light on until pursing was completed. The skiff would then move across corkline and resume fishing with light after anchoring clear of seiner and net.

The total catch weight was estimated by vessel captain after net bunt was dried up. A sample was brailed into a large plastic container to be weighed, sorted, and identified while fishermen handled catch and restacked the net. This general procedure was followed during each set.

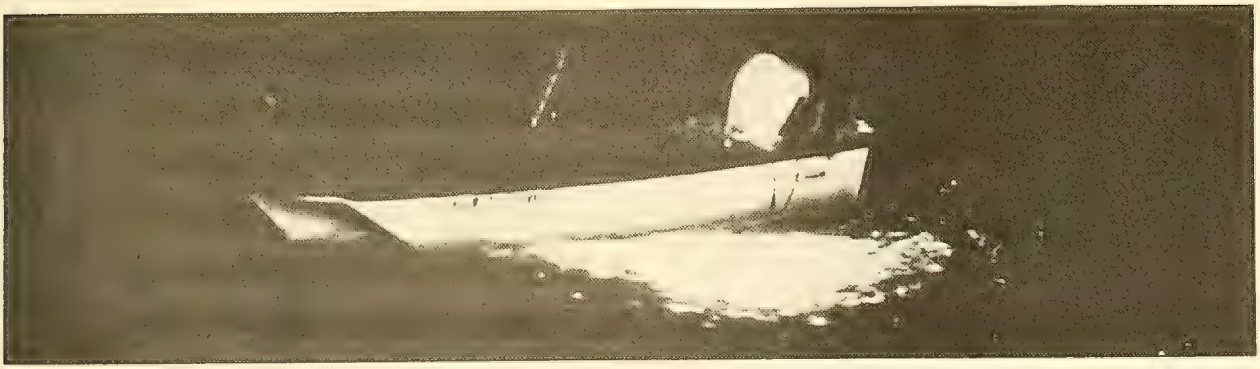

Fig. 4 - The light skiff anchored on station with 1,000-watt mercury-vapor underwater attracting-light turned on. A large school of fish has accumulated around light, considerably reducing size of light field.

B. Catch Results

1. Attraction of Fish by Artificial Light

The operation of passive fishing gear (traps, bait, and artificial light) requires that fish pass within its effective zone of attraction before they can be subject to capture. So the catch of a passive gear depends on size of its zone of attraction and fish density therein. The characteristics of capture zone is not consistent because variables--turbidity, ambient light, biological rhythms, and many others--influence effectiveness of gear and/or susceptibility of animal to capture; this variability is reflected in catches.

Catches from individual sets around the light showed considerable intranight and internight variability.

a. Intranight variability

Catch data averaged by set time for new and full moon periods, disregarding location and other variables, indicates that artificial light was effective in attracting fish throughout the night (Figure 5). There was consistency in average catches for the three nightly sets, during both new and full-moon periods (Figure 5). This suggests that intranight catch variability for individual sets probably resulted from different fish densities in envelope of water within which light was effective. This conjecture was supported by visual observations and echo-sounder tapes made from the light skiff. These indicated that schooling species, the bulk of larger catches, usually arrived in the light field in large numbers at infrequent intervals; the remaining species appeared to accumulate gradually. These results contrasted with lift-net sampling that indicated early evening and predawn peaks for light-attraction effectiveness. In view of purse-seine catch, peak periods for lift-net catches may be indicative of changes in dispersion distance around artificial light. This arises, possibly, from rhythmic physiological changes in fishes' sensitivity to light.

b. Internight variability

Internight variability in total catch resulted primarily from environmental factors--location, water turbidity, thunderstorms, and others--which could affect catch and light's attraction characteristics. Some effects of location on catch are shown in Figure 1. However, the present data are not sufficient to permit analysis of effects of environmental factors on light-attracted catches.

c. Lunar pattern

The effects of moon phase on attraction by artificial light are noticeable in comparison of average catches per set by moon phase. Figure 5 shows average catch per set was considerably larger during new moon than during full moon. Present data only permit speculation on causes of different catch rates for these two lunar periods. However, it is probably that bright ambient light during full moon reduces contrast between artificial light and background, thereby reducing appreciably the extent of effective attraction zone. Also, physiological changes related to lunar cycle could render fish less susceptible to attractraction by artificial light. In terms of potential fishing applications of artificial light, fish were attracted successfully during both new and full moon. The full importance of moon phase to commercial application of light attraction requires accumulation of considerably more comparative catch data than provided here.

2. Species Composition

Over 50 species of fishes were identified in catches from purse-seine sets made around artificial light. Menhaden are not commonly fished in the study area; none was caught. Spanish sardine, Atlantic thread herring, and scaled sardine, usually bulk of larger catches, were estimated as having greatest commercial potential among latent coastal pelagic resources in the Gulf. Their combined contribution was 50% or more by weight in 71% of catches (Figure 6).

3. Comparison With Conventional Purse-Seine Catches

Nightly catch totals are not all based on full night's fishing of 3 sets. Nevertheless, they still average slightly better than 2,500 pounds per night for entire study. Catches made during new moon periods alone averaged better than 3,000 pounds per night, although only 2 of the 7 nights fished consisted of a full 3 sets.

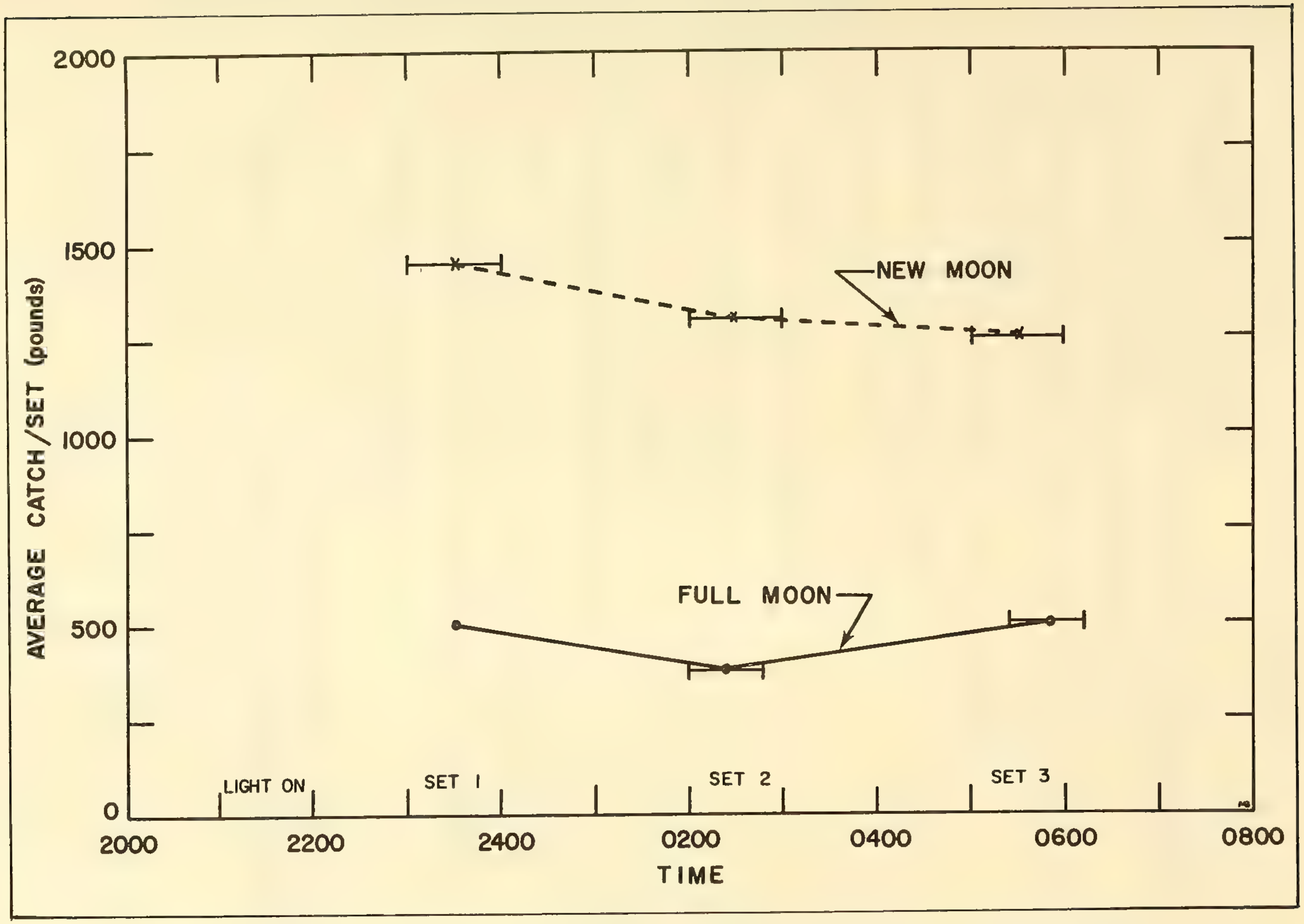

Fig. 5 - Catch data averaged by set time for new and full moon charter periods. Locations and other variables were disregarded.

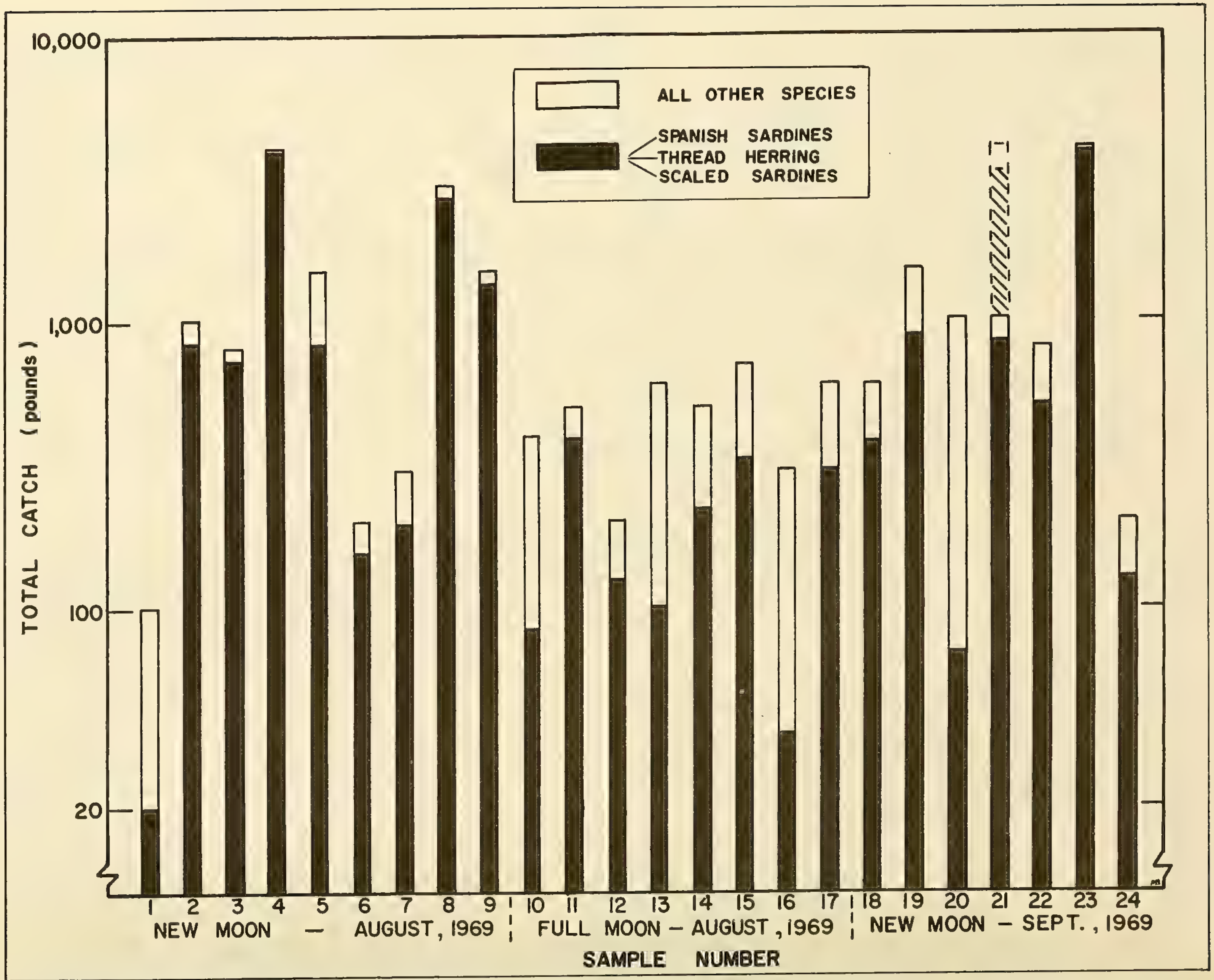

Fig. 6 - Combined contribution, by weight, of Spanish sardine, Atlantic thread herring, and scaled sardine to total catch for each nightlighting purse-seine sample. Sample 21 has been extended to account for estimated 3,000 to 4,000 pounds lost because of gear trouble.

Compared with conventional daytime purse-seine fishing in general study area, our nightly total catch average was lower than average of 4,000 pounds per set reported by captain of our chartered bait seiner.

C. Summary and Conclusions

This study indicates that artificial light can be used to aggregate coastal pelagic fishes, the greatest latent commercial potential in Gulf of Mexico. These species can be attracted throughout night, although moon phase, probably because of ambient light levels, appears to affect size of aggregations.

The pattern of fish aggregation indicates that effectiveness of artificial light depends on fish density, as would be expected for any passive attracting gear. For maximum effectiveness, light attraction should be used in high-fish-density areas. Lights in high-density areas would need to be set on more frequently during night than lights in low-density areas. The formation of large fish concentrations early in evening would block light and reduce its continued efficiency, therefore restricting its potential total night's production. Conversely, lights in low-density areas would need to be set on only once each night just prior to morning twilight.

We showed that a purse seine could be set around an artificial light. Our experience indicates that fish attracted to light are not greatly disturbed by encircling net. Therefore, purse-seine sets can be made slowly around a light allowing for maximum gear deployment. These sets also would require less skill than for successful conventional sets because fish remained undisturbed within light field. So unsuccessful sets could almost be eliminated by using artificial light. An additional advantage would be financial savings realized by locating light-fishing sites in known areas. This would reduce search time, a high cost in purse seining.

Nightly total catches from our single light source ranged from 500 to 6,300 pounds, and averaged about 2,500 pounds throughout 3 fishing periods. Despite advantages, use of light as accessory technique to purse seining is not likely to be accepted by fishing industry until catches can be increased.

Preliminary observations indicate that fish follow a slow-moving light for short distances. This suggests that fish aggregations from several lights possibly could be led to single area for more efficient harvesting. Considerably more study is required before feasibility of leading fish can be determined and useful techniques developed for incorporation into a fishery.

This study strengthened our contention that artificial light can be developed as a supplement to conventional purse seining for more efficient harvesting of latent coastal pelagic resource of Gulf of Mexico. It provides encouraging indications that artificial light can be incorporated into proposed National Marine Fisheries Service netless harvesting system (Klima, 1970). The studies required for both immediate and long-term applications of light attraction are now in progress at the National Marine Fisheries Service, Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi.

ACKNOWLEDGMENT

Bennie A. Rohr, National Marine Fisheries Service, Pascagoula, Mississippi, provided species identifications and assisted in field work. John R. Watson Jr., cooperative student, University of West Florida, manned light skiff.

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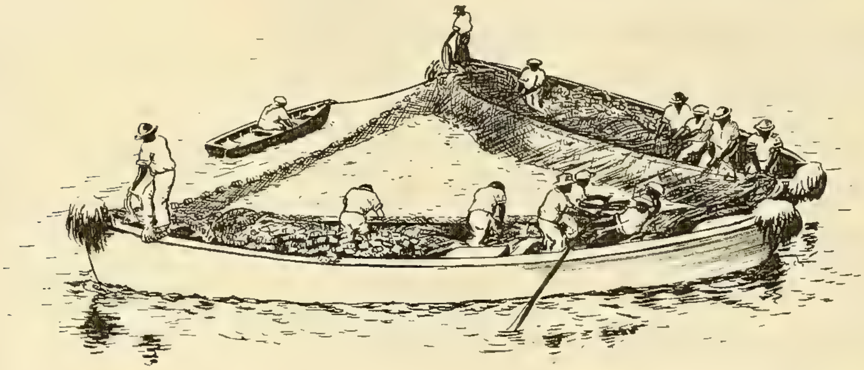

Evidence indicates that ——

A PREMIX OF FPC & WHEAT FLOUR CAN BE MADE & TRANSPORTED

Virginia D. Sidwell, Bruce R. Stillings,
& George M. Knobl Jr.

The authors conducted a study to determine if mixtures of wheat flour and fish protein concentrate (FPC) would tend to separate during the agitation of a mechanical shaker. Mixtures of 90% wheat flour and 10% FPC were placed on a shaker for 168 hours. Despite differences in particle size between the wheat flour and the FPCs, there was no evidence of separation.

FPC is intended to be used as a protein ingredient in foods. It has been used successfully in a variety of baked products (Sidwell, et al., 1970). When used in products based on wheat flour, FPC either could be added directly to the other ingredients--or an FPC-wheat flour premix could be prepared and used later in the products. The premix would be advantageous because it could be prepared easily in bulk at large industrial centers. It could then be shipped and distributed to food-processing plants in this country or in foreign countries.

Wheat flour and FPC particles, however, may differ in size and other characteristics. Because of these differences, separation might occur during shipment and result in a non-uniform premix. The purpose of our experiment, therefore, was to determine if mixtures of wheat flour and FPC separated when subjected to continuous agitation.

MATERIALS AND METHODS

The wheat flour used was a patent, bromated, enriched bread flour obtained from the Pillsbury Company, Minneapolis, Minnesota.

The FPC was prepared by isopropyl alcohol extraction of red hake (Urophycis chuss) (Bureau of Commercial Fisheries, 1966). Two FPC samples were used that had been ground in different mills to produce material with different particle sizes. One sample was milled in a Rietz disintegrator[1/] and was relatively coarse; the second sample was milled in a fluid energy mill and was relatively fine.

The wheat flour and the two FPC samples were analyzed for crude protein by the method described in Section 2.044 of the AOAC Methods of Analysis (1965). The moisture content was analyzed by drying the samples in a forced-air oven for 16 hours at 100° C. Ash was determined by burning the samples in a muffle furnace for 16 hours at 550° C.

The particle size distribution of the samples was determined with a Ro-Top Testing Sieve Shaker. This consisted of a series of four U.S. Bureau of Standard Sieves, which had the following pore sizes: 149, 105, 44, and 37 microns. One hundred-g samples were placed on the top sieve and the shaker was run continuously for 30 minutes. The material remaining on each sieve was then weighed separately.

Dr. Sidwell is Supervisory Food Technologist, Dr. Stillings, Supervisory Research Chemist, & Dr. Knobl, Research Director, National Center for Fish Protein Concentrate, National Marine Fisheries Service, College Park, Maryland 20740.

1/Trade names are used merely to facilitate descriptions; no endorsement is implied.

COMMERCIAL FISHERIES REVIEW
Reprint No. 901

The bulk density of the wheat flour and FPC samples was determined also. Each sample was carefully poured into a 25-ml graduated cylinder with an opening of 1 cm. The sample was removed and weighed. The bulk density was calculated by dividing the 25-ml volumes into the weight of the sample.

Two wheat flour-FPC mixtures were prepared: one contained the coarsely ground FPC, the other the finely ground FPC. Each mixture weighed 2 kg, and each contained 90% wheat flour and 10% FPC. Two wide-mouth, 1-gallon glass bottles were lined with polyethylene bags. The wheat flour-FPC mixtures were transferred loosely to the bags, which were then tied. There was a small head space at the top of the containers. The tops were placed on the glass jars and they were placed on an Eberbach mechanical shaker operating at 60 oscillations per minute. The samples were allowed to shake back and forth continuously for 168 hours.

At the end of this period the mixtures had settled and there was approximately a 2-inch head space in the jars. The jars were scored with a glass cutter and carefully cracked open, so as not to disturb their contents. The polyethylene bags were cut lengthwise. Two random samples were taken from each of the top, middle, and bottom portions of the mixtures. To determine if separation had occurred during shaking, these samples were analyzed for protein, moisture, and ash by the methods previously described.

RESULTS AND DISCUSSION

Table 1 shows the particle size distribution in the two samples of FPC and the sample of wheat flour. The Rietz-milled FPC and the wheat flour were somewhat similar in particle size distribution. The fluid energy-milled FPC, however, was considerably finer than the other two samples. This FPC was not gritty in texture, whereas the Rietz-milled FPC had a definite gritty texture.

Table 2 shows the protein and ash contents and the bulk densities of the wheat flour and FPC samples. It is evident that there was a considerable differential between the wheat flour and the FPCs in their contents of protein and ash. Also, the bulk density of the wheat flour was slightly higher than that of the FPCs.

Table 1 - Particle size distribution of wheat flour and FPC (fish protein concentrate) samples[a]

Sieve opening	Sieve No.[b]	Wheat flour	FPC: Rietz-milled	FPC: Fluid-energy milled
		Percent by weight of samples held by each screen		
μ		%	%	%
149	100	0.0	0.5	0.0
105	140	12.3	14.3	0.5
44	325	68.3	44.8	0.6
37	400	16.8	9.0	30.2
<37	-	2.8	30.6	68.2

[a] Values are expressed as percent of the sample retained on indicated screen. Values for <37 μ are percentages of samples that passed through screen with openings 37 μ in size.
[b] Indicates approximate number of openings per lineal inch for U. S. Bureau of Standards Standard Screen Series.

Table 2 - Protein and ash contents and bulk densities of wheat flour and of FPC (fish protein concentrate) samples[a]

Samples analyzed	Crude protein[b]	Ash	Bulk density
	Composition of samples		
	%	%	
Wheat flour	11.8	0.47	0.535
FPC:			
Rietz-milled	87.7	13.1	0.488
Fluid energy-milled	87.6	11.5	0.450

[a] Values are expressed on a moisture-free basis.
[b] Nitrogen x 6.25.

Table 3 shows the protein and ash composition of the mixtures of wheat flour and FPC before and after shaking. After 168 hours of continuous shaking, the protein and ash contents of the mixtures at the three locations were nearly identical. These values were also nearly identical to those for the whole mixtures before shaking. These results show that no significant separation occurred in the mixtures during shaking.

The results from this study indicate that mixtures of wheat flour and FPC do not tend to separate during agitation. Although confirmation of these results under practical conditions is needed, they indicate that a premix of wheat flour and FPC could be prepared and transported without separation occurring.

Table 3 - Protein and ash contents of wheat flour and FPC (fish protein concentrate) mixtures before and after shaking for 168 hours[a]

	Composition of mixtures			
	Wheat flour 10% Rietz-milled FPC		Wheat flour 10% fluid energy-milled FPC	
Time and location of sampling	Crude protein[b]	Ash	Crude protein[b]	Ash
	%	%	%	%
Before shaking:				
Whole mixture	20.0	1.84	20.1	1.58
After shaking:				
Top of mixture	20.3	1.79	20.5	1.57
Middle of mixture	20.0	1.79	20.4	1.57
Bottom of mixture	20.1	1.77	20.4	1.57

[a] Values are expressed on a moisture-free basis. Each value is an average of duplicate analyses on each of two samples taken from each location.

[b] Nitrogen x 6.25.

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SOVIET SCIENTIST ASSESSES FUTURE OF WORLD FISHERIES

The Deputy Director of the Soviet Federal Fisheries and Oceanography Research Institute, Prof. Peter Moiseev, painted this picture of the future of world fisheries in 'Vodnyi Transport' in mid-1970:

The Ocean's Productivity: Bioproductivity is adequate in only 33% of the total ocean area--mostly in waters of the Continental Shelf and Slope, where over 70% of the oceans' phytoplankton is concentrated. Enough zooplankton is produced to support 300 million metric tons of fish and large invertebrates (squid, crab, and shrimp).

Commercially Exploitable Marine Grounds: Since most organic productivity occurs in water layers penetrated by sunlight, only depths to 600-800 meters can be fished commercially. The Continental Shelf and Slope yield 95% of world catch. Only 11% of ocean is less than 1,000 meters deep. The biological equilibrium between marine genera, families, and species can be disrupted by large-scale commercial fisheries that reduce abundance of stocks.

Maximum Sustainable Yield (MSY): Of ocean's productivity potential of 300 million tons, only 90-100 million tons can be harvested--provided commercial fisheries are regulated, which is imperative. In one hour of trawling, a large stern trawler takes an annual "crop" of 10 square kilometers of the Shelf; one purse-seine haul takes the "crop" of 100-500 square kilometers.

Intensive combined fishing by several nations in relatively small areas has depleted resources. Moiseev cited halibut off U.S. Pacific coast, flounder off Australia and in European waters, Pacific and Atlantic salmon, and Atlantic Ocean perch.

Expanded World Catch: If commercial fisheries are regulated effectively, total catch can be substantially increased--by expanding saury, horse mackerel, mackerel, anchovy, and squid fisheries. The largest concentrations of these occur 100-500 and more kilometers from shore.

Harvesting New Species: Moiseev recommended maxiumum commercial exploitation of small crustaceans that feed directly on plankton, especially Antarctic krill. He estimated resource at "many hundred millions of tons," and its MSY greater than today's world fisheries catch.

Fisheries Management and Fish Farming: To increase catches, expanded management, improved fishing techniques and gear, and organized large-scale fish farms are required. Moiseev suggested introduction of marine farms to breed fish, invertebrates, and algae useful to man.

He proposed that countries with major marine and distant-water fisheries combine to "organize a scientifically supported commercial fishery." He also favored an internationally agreed-upon period to study the oceans' biological resources, and the conditions, methods, and techniques for rational utilization and multiplication of marine fauna.

STOP MARINE POLLUTION AT SOURCES, FAO CONFERENCE RECOMMENDS

The only effective way to control pollution of the environment is to strike at the sources, agreed scientists at an FAO conference in Rome in Dec. 1970. The 415 environmentalists recommended ways to maintain the world "in a state in which man can thrive and evolve."

The conference recognized "the urgent need for a coordinated approach to marine pollution control" because this pollution was caused by agents from the atmosphere and the land, through river discharges, and by dumping and other direct contamination of oceans.

Local Action

Pollution can be countered at the source in most cases by "applying restraint, by local action under national jurisdiction, so as to restrict releases to levels and methods accepted as potentially harmless."

The possibility of recycling wastes in some instances was seen as a solution. The conference recommended that "research on waste-recycling techniques in industry should be encouraged as widely as possible."

Global Monitoring Needed

A global system for marine pollution monitoring received major attention. The first objective, the conference agreed, must be to provide data and information on the state and trends of ocean pollution. The purpose is to facilitate management measures and their enforcement.

As a first step, existing national monitoring programs, particularly in areas with a risk of heavy pollution, should be encouraged to cooperate in pilot regional monitoring exercises. These should be similar to those now being organized by International Council for the Exploration of the Sea (ICES) for North and Baltic Seas.

A conference resolution stated: "Such regional projects will provide the world with experience both in necessary techniques and in management of monitoring. They will at the same time facilitate contacts between the relevant laboratories regarding the essential basic research, the substances to be monitored, the sampling procedures and the analyses of pollutants."

Exploratory Survey Urged

To facilitate establishment of a global monitoring program, the conference urged a prompt preliminary exploratory survey by international cooperation to evaluate ocean pollution.

The survey's aim would be to "establish the levels of various substances--natural and artificially introduced--in the water column, together with their accumulation in the plankton, the benthos (plants and animals at the bottom of the sea), the fish and the sediments." The coastal zone should receive special attention.

The survey should relate to existing and proposed systems for monitoring terrestrial environment and the atmosphere.

"Cooperation among the international agencies responsible for monitoring all three of these components of the biosphere is essential," the conference said. "Their monitoring systems must be developed in close coordination so as to provide the maximum information and understanding through collaboration."

Off-Shore Dumping

Deliberate off-shore dumping in the high seas poses problems: It pollutes. It may produce physical (handling) problems and even dangers to fishermen. It may create international problems if done "extra-territorially."

The conference urged that "deliberate dumping of toxic wastes on recognized fishing and other shallow grounds be prohibited." It noted the accumulation of mercury by aquatic organisms "and the tragic consequences of mercury pollution to human health, particularly as exemplified by the so-called 'Minimate disease' in Japan. Moreover, because of the hazards of mercury poisoning and the banning of contaminated fish, the fishing industry in many parts of the world has suffered severe economic losses."

The conference said technology now is available to virtually eliminate losses caused by mercury. It recommended that governments act to "require advanced techniques for mercury recovery in all factories producing mercurial products or using mercury or its compounds as catalysts, cathodes or for other purposes in production." It also recommended that "seed-dressings, slimicides and other mercurial compounds be replaced at the earliest possible time by other non-mercurial subsitutes."

HALT DESTRUCTION OF CORAL REEFS, SCIENTISTS URGE

Scientists at the FAO Marine Pollution Conference in Rome, Dec. 1970, urged action to halt destruction by pollution of coral reefs. Reefs were described as "the most biologically productive of all natural communities, marine or terrestrial, for which measurements are available."

Dr. R. E. Johannes, Department of Zoology, University of Georgia, declared: "Undoubtedly only a small fraction of the damage man has done to coral reefs has been recognized and an even smaller fraction has been brought to the attention of those who could do something about it."

To anticipate man's impact on coral reefs, Dr. Johannes said, much more study of the environmental tolerances of the organisms comprising coral reef communities is needed. Investigations of corals have shown that these animals are very important. When they are killed, other reef fauna soon migrate or die. This dooms the reef.

Urges Surveys

He urged surveys of reef resources, particularly near populated areas, "just as we do with terrestrial communities." He said economists, biologists, and geologists should be involved in the surveys--because "the courtrooms of societies that respect money cannot be counted on to be responsive to aesthetic arguments in pollution cases."

Dr. Johannes noted the State of Hawaii survey of pollution effects on coral reefs in Kaneohe Bay. The survey included detailed evaluation of the monetary value. It "thus provides at least a partial measurement of the threat posed by pollution in terms the voter, the politician and the businessman understand."

Extent of Coral Reefs

Lagoons formed by coral reefs are scattered over 190,000,000 square kilometers. They supply high-quality protein food-fish to people living near the sea in the tropics, where terrestrial sources of protein often are inadequate. Also, the reefs are buffers against the ocean. They permit continued existence of about 400 atolls and many other low tropical islands. They preserve thousands of miles of continental coastlines.

"The uniquely peaceful and beautiful vistas that reefs present to the human visitor is a psychological resource to which any coral reef diver will bear witness," Dr. Johannes said. He cited many examples of destruction, or threats of destruction, to coral reefs. These ranged from Great Barrier Reef off Australia to those off Virgin Islands, Jamaica, and Bermuda.

WORLD FISHERIES CATCH DROPPED IN 1969

For the first time since 1948, the world's fisheries catch declined in 1969, The FAO Yearbook of Fishery Statistics for 1969 (published recently) gives 1969 world catch as 63.1 million metric tons; it was 64.3 million tons in 1968.

The strongest decline was in marine-fish catch: from 50 million tons in 1968 to 48.6 million in 1969. Actual landings, however, declined less: from 47.9 million tons to 47.2 million. The main reason appears to be lower production in some major industrial fisheries caused by a decrease of about 1.6 million tons in anchoveta catch, and about 1 million tons in Atlantic herring catch.

The Leaders

Of the 3 nations with catches above 5 million tons, only the Soviet catch increased (6.1 to 6.5 million tons); Peru's declined from 10.5 to 9.2 million; Japan's from 8.7 to 8.6 million.

U.S. catch increased from 2.4 to 2.5 million tons; U.S. won 5th place from Norway (down from 2.8 to 2.5 million tons).

1-Million-Ton Club

Among the "one-million-ton fishing countries", South Africa dropped from 2.2 to 2.13 million tons; India rose from 1.53 to 1.61 million tons; Canada fell from 1.5 to 1.41 million tons; Denmark slipped from 1.47 to 1.28 million tons; Thailand moved up from 1.09 to 1.27 million tons, Indonesia increased from 1.16 to 1.21 million tons; U.K. went up from 1.04 to 1.08 million tons; and Chile declined from 1.38 to 1.08 million tons.

The "one-million-ton fishing countries" account for about 60% of world catch: 37.7 million tons. ('Fishing News', Dec. 18/24, 1970.)

MEETINGS

OCEANEXPO 71 IN FRANCE MARCH 9-14

An international exhibition on the exploitation of the oceans will be held in Bordeaux, southern France, March 9-14. A helicopter shuttle will transport visitors from airport to exhibit center.

The program includes these subjects:

Exploitation of Ocean Resources
Industrial Development of the Continental Shelf
Exploration of the Marine Environment
Possiblities of Exploiting Ocean Depths
Industrial Development of the Seacoast
Marketing Marine Products and Developing Marine Cultivation
Analyzing and Forecasting Environmental Conditions

WORLD FISHING EXHIBITION IN DUBLIN MARCH 24-30

Dublin, Ireland, is hosting the 5th biennial World Fishing Exhibition, formerly held in London, during March 24-30. The sponsors say 15 or 16 countries will be represented.

Concurrent with the exhibit of many engines will be a display of fish and fish products at new British rail terminal at Dun Laoghaire, not far from main exhibition.

FISHERIES TRADE FAIR IN DENMARK MAY 14-23

The 7th International Fisheries Trade Fair will be held in Frederikshavn, Denmark, May 14-23, 1971. An exhibition area and mooring accommodations are available.

The fair will include "fishing vessels of all constructions," marine engines, deck machines, nets and ropes, navigation and life-saving equipment, and electronic gear.

There are daily sailings between Frederikshavn and Norway and Sweden.

Villagers in Java, Indonesia, set fish in communal fish pond.
(FAO photo: D.G.O. Davies)

ASIA

JAPAN

EXPAND SKIPJACK-TUNA SURVEYS IN SOUTHWESTERN PACIFIC

The Japanese Fisheries Agency and private firms are continuing to expand their skipjack-tuna surveys in southwestern Pacific.

Back in 1968, the Agency's 'Toshitaka Maru' (186 gross tons) traveled to Papua and New Guinea on 3-month survey to help establish Japanese-Australian ventures there. Since then, the vessel has conducted three 2-3 month surveys.

1969 & 1970 Surveys

In 1969, the Shizuoka Prefectural Fisheries Experimental Station sent 'Fuji Maru' (332 gross tons) and 'Suruga Maru' (186 gross tons) to southwestern Pacific. The latter is still investigating there.

In 1969 and 1970, the Fisheries Association of Japan conducted a government-subsidized survey of land facilities in New Guinea area to determine feasibility of establishing foreign-affiliated ventures.

Firms Interested

Based on the Agency's survey data, Japanese firms are keenly interested in developing skipjack resource. Kyokuyo Hogei joined Australian interests to form Gollin Kyokuyo, now shrimp fishing in Gulf of Carpentaria. Hogei has been conducting exploratory pole-and-line skipjack fishing off New Ireland Island since March 1970 with 1,000-gross-ton mothership 'Akitsu Maru No. 5' and three 39-gross-ton Okinawan vessels.

Full-Scale Fishing

Catches have been good--4-5 metric tons per vessel per day of fishing--and the joint company will begin full-scale commercial fishing this year. It will build a cold storage in Kavieng, New Ireland.

Other Exploratory Fishing

Two other firms, Hokoku Suisan and Nihon Suisan, are scheduled to start exploratory skipjack fishing from Manus Island off northern New Guinea.

The Japanese Overseas Fishery Company at Penang, Malaysia, will fish in that region from its base at Rabaul, New Britain Island (Bismarck Archipelago). ('Katsuo-maguro Tsushin', Nov. 2; 'Suisan Tsushin', Oct. 31, 1970.)

* * *

SEINER TO FISH TUNA IN E. TROPICAL PACIFIC & ATLANTIC

The 500-gross-ton Japanese purse seiner 'Hakuryu Maru No. 55', owned by Kawajiri Fisheries Co., left Japan Nov. 16, 1970, for eastern tropical Pacific yellowfin tuna regulatory area.

The vessel was scheduled to fish yellowfin tuna from early December 1970 until April 1971, and then proceed via Panama Canal to eastern Atlantic. There, it will fish off Ghana from July to Nov. 1971.

Failed in 1969

In 1969, vessel failed dismally in eastern Pacific yellowfin fishery. Her crew is determined to improve. ('Suisan Keizai Shimbun', Nov. 17, 1970.)

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VESSEL EXPLORES FOR TUNA IN SOUTHEAST PACIFIC

The Government-chartered, Taiyo-owned 314-gross-ton longliner 'Azuma Maru No. 38', built in 1970, is exploring the tuna resource of southeast Pacific. US\$178,000 was budgeted for fiscal year 1970 (Apr. 1970-Mar. 1971).

Not Much Success

She began exploring southeastern Pacific on Aug. 3, 1970, without much success. In Sept., she caught 55 tons of fish, which included 61% albacore and 35% big-eyed. Her catch in Oct. 1970 totaled only 28 tons (78% big-eyed tuna mixed with albacore, yellowfin, and swordfish). In early Nov. 1970, she explored near 25° S. latitude and 87° W. longitude (off northern Chile).

The vessel will survey south of 40° S. latitude for bluefin tuna. Return to Japan is scheduled for Mar. 1971. ('Katsuo-maguro Tsushin', Nov. 12, 1970.)

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JAPAN (Contd.):

FISH ILLEGALLY FOR KING CRAB OFF WESTERN KAMCHATKA

The Japanese fear that a king-crab poaching incident may affect Soviet-Japanese 1971 crab negotiations. In late Oct. 1970, the Japanese Maritime Safety Agency (MSA) raided 3 fishing vessels and a warehouse in Miyagi Prefecture and confiscated 25,000 cases (15 kg. each) of king crab.

MSA is pressing charges against 2 Yasukata-based companies for illegally fishing king crab in restricted areas of Okhotsk Sea off western Kamchatka between August and mid-Oct. 1970.

1969 Incident Too

In 1969, another firm was involved in an identical situation. Its vessel had illegally caught king crab in area of Okhotsk Sea where fishing had not been authorized by Japan-USSR Fisheries Agreement. At that time, the Japanese confiscated 2,000 cases and suspended one vessel for a month. ('Japan Times', Oct. 31, 1970.)

25,000 Cases Confiscated

MSA believes 1970's poaching was in part an attempt by firm to compensate for losses resulting from 1969 poaching.

The 25,000 cases confiscated in 1970 were worth US$280,000--about 14% of Japanese king crab quota off western Kamchatka under USSR-Japan King Crab Agreement.

* * *

LAUNCH STERN TRAWLER & REFRIGERATED TRANSPORTS FOR S. KOREA

A 3,000-gross-ton stern trawler ('Kaeyang') and a 1,650-ton refrigerated transport 'Chilbosan No. 3' ordered by Koryo Fishing Co. of S. Korea were launched at Hayaskikane Shipyard in Nagasaki.

Another 1,650-ton carrier, 'Chilbosan No. 5', is being built at a Korean shipyard in Pusan.

The 3,000-ton 'Takyang' was launched at Hayashikane Shipyard in Shimonoseki for Koryo.

To Fish Alaska Pollock

When completed end of 1970, the trawlers will fish Alaska pollock in North Pacific. The fish is popular in Korea, where it brings high price: 80 yen a kilogram (US$202 a short ton).

Koryo's Marketing Plan

Koryo plans to market fish from distribution point at Pusan. It is building a cold-storage plant there. Before, Koryo had concentrated on tuna fishing for export. Now it is expanding fishing operations to supply Korea.

Koryo's Fleets

Including vessels now under construction, Koryo will have 37 tuna vessels (ten 230-ton longliners, seventeen 350-ton and ten 530-ton vessels, a total of 13,550 gross tons); 2 stern trawlers (total 6,000 gross tons); and four refrigerated transports (total 5,300 gross tons). Combined total: 24,850 gross tons. ('Suisancho Nippo', Nov. 26, 1970.)

* * *

STUDY SHRIMP STOCKS IN BAY OF BENGAL

Kyokuyo Hogei is exploring shrimp grounds in northern part of Bay of Bengal. In Sept. 1970, the company began to use a 100-GRT shrimp trawler based at Khulna (East Pakistan). If the 1-year project is successful, Hogei will establish a joint venture with a local cold-storage company.

First Joint Venture

The plan was attractive to the Japanese fishing industry because there had been no Japanese-Pakistani fishing ventures. Foreign fishing had been restricted by Pakistani claims to a 12-mile territorial sea and a 112-mile conservation zone.

In the past, other Japanese firms attempted to work out a similar plan. They were unsuccessful because the fishing area in northern part of Bay of Bengal is narrow, and shrimp season is closed for 6 months. The peak season is during the winter rains. ('Shin Suisan Sokuho')

* * *

JAPAN (Contd.):

SHRIMP TEAM VISITS THAILAND & INDIA

An 8-man Japanese "shrimp mission" visited Thailand and India for 2 weeks in Nov. 1970. It was sent by the Japanese Fishery Products Importers Assoc.

The team conferred with government and industry leader on: (1) possibilities of developing new shrimp grounds; (2) use of small shrimp and crayfish; (3) more Japanese help in improving quality; (4) establishing export inspection system; (5) measures to reduce Japanese import costs (such as ocean freight); and (6) more cooperation by Thailand and India.

Earlier Mission

Earlier in 1970, Japan had agreed to sell 20 refrigerated trucks, worth about US$278,000, to Thailand to help solve the land transportation problem. In 1969, Japanese technicians were sent to Thailand and India on a 3-month training program to help improve shrimp quality.

Japan Seeks Larger Supply

The Japanese hope that new shrimp grounds can be developed in India and other southeast Asian countries. These would supply Japan with shrimp she will need in the future. ('Nihon Suisan Shimbun', Nov. 6, 1970.)

* * *

JAPANESE ATE LESS FISHERY PRODUCTS IN 1969

Annual per-capita consumption of fish and shellfish in Japan in 1969 was 30.7 kilograms (67.5 pounds), down 5% from the 32.4 kilograms (71.3 pounds) in 1968. This was reported by the Ministry of Agriculture and Forestry.

First Drop in Decade

From 1960-1968, per capita consumption increased steadily. The 1969 decline was the first in 10 years. ('Suisan Tsushin', Nov. 10, 1970.)

* * *

MECHANICAL TUNA GEAR PERFECTED FOR COMMERCIAL USE

The mechanical skipjack-tuna poles, developed by Suzuki Ironworks, have been established as practical labor-saving devices. On Nov. 28, 1970, 10 units were installed aboard skipjack vessels and 40 more will be installed. The Fisheries Agency supports the new gear.

Commercial Use

The manufacturer has named the device "Roback K-70". It is the only one ready to be used commercially. Several similar devices are being developed in Japan. The gear's effectiveness in southern waters will be watched closely. ('Suisan Keizai Shimbun', Dec. 7, 1970.)

Prototype Modified

The major problem encountered with the first gear was that the tensile strength of the bamboo poles proved uneven. This caused fish to fall off hook. Suzuki will manufacture an improved gear. It will also study use of glass rods to obtain uniform strength.

* * *

JAPAN PROTESTS U.S. BAN ON IMPORTING WHALE PRODUCTS

The U.S. placement of eight species of whales on the endangered species list--thus barring imports of their products--has stunned the Japanese whaling industry.

In 1969, Japan exported to the U.S. $2.4 million worth of whale meat and oil. This included 8,700 tons of sperm-whale oil, 87% of Japan's exports of that product. The U.S. action will put sperm-whale oil in short supply in the U.S. and create a surplus in Japan despite growing domestic demand for it.

Japan Protests

In late Nov. 1970, Japan reportedly protested to U.S. State Department. She claimed U.S. action was unjust and urged removal from endangered list of species whose inclusion would hurt Japanese industry. ('Suisan Tsushin', Dec. 4; 'Suisan Keizai Shimbun', Nov. 27, 1970.)

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JAPAN (Contd.):

JAPANESE-PHILIPPINE SHRIMP VENTURE

To increase shrimp purchases from the Philippines, the Nichiro Fishing Co. recently established South Sea Fisheries Research Inc. in partnership with Ramos Co., a local Philippine firm. Ramos contributed 70% and Nichiro 30% of the $33,000. A small cold-storage plant was leased at Bacolod, Negros Island, and began operations Dec. 1, 1970.

Japanese Purchases Rise

Though shrimp is abundant off the Philippines, much is consumed locally and little is left for export to Japan. In Feb. 1970, to stimulate exports and earn hard currency, the Philippines lowered the exchange rate from 3.9 pesos to 6 pesos per US$1. This benefited Japanese firms, which began to buy more shrimp.

In 1969, Japan had imported from the Philippines around 100 metric tons of frozen shrimp; by the end of October 1970, imports had increased to 230 tons. Nichiro purchased only about 30 tons, but the joint venture is paving the way toward larger purchases. ('Suisan Keizai Shimbun', Dec. 4, 1970.)

NMFS Comment

Comment by NMFS Division of Foreign Fisheries:

The Japanese began to show an interest in Philippine shrimp in late 1968 when it became obvious that domestic demand would exceed supplies in the coming years. In Oct. 1968, the Government subsidized 75% of 1-month trip of 8-man "shrimp survey team," organized by Japanese Association of Importers of Marine Products, through Southeast Asia; the Philippines was included. Findings were published in Dec. 1968: Japanese traders were warned that quality of shrimp imports from Philippines might be below standard. Shrimp dealers are concentrated in Manila--but shrimp are landed in other ports and transferred to Manila with considerable delay. Supplies were limited and high priced.

In 1969, the Philippines caught about 53,100 metric tons of shrimp (29,600 tons were fresh-water species). This was only 10% above 1968, when 49,000 tons of marine and fresh-water shrimp were landed.

* * *

PLANS JOINT FISHING VENTURE IN GAMBIA

The fishing firm, Nichiro, and trading firm, Marubeni Iida, have agreed with Gambian Government and local firms to form a joint fishing and processing venture in Gambia in Jan. 1971. Capitalization is US$240,000: Marubeni Iida, 37%; Nichiro 35%; Gambia 10%; and local private interests 18%.

The Plans

The company will fish for tuna and shrimp, and process and freeze fish. The Japanese partners were requested to construct a 500-ton cold storage plant by May 1971 and to provide trawlers.

Crayfish will be harvested with canoes and nets, processed, and exported mainly to France--but also to other European countries. ('Suisan Tsushin', Dec. 8, 1970.)

* * *

SURVEY COSTA RICAN & NICARAGUAN FISHERIES

Two experts of the Japanese Fisheries Agency surveyed Costa Rican and Nicaraguan fisheries throughout Nov. 1970. Costa Rica and Nicaragua had requested the surveys to promote their fisheries.

Interested In Skipjack

The team studied the fisheries, including only skipjack among the tunas. It will determine the feasibility of Japanese fishery cooperation. The agency is especially interested in skipjack resource; Costa Rica and Nicaragua want to develop it because U.S. tuna packers import much raw skipjack. ('Katsuomaguro Tsushin', Nov. 13, 1970.)

* * *

SOUTH KOREA

PLANS TO QUADRUPLE OYSTER PRODUCTION

The Republic of Korea (ROK) Fisheries Office will spend about 2.6 billion won (US$9.4 million) in a 6-year period to quadruple oyster production. Oyster culture off southern coast will be improved with funds from ROK, local governments, and private interests.

Annual Allocations

Annual allocations: 1970: 300 million won ($1.1 million); 1971: 488 million won ($1.8 million); 1972: 488 million won ($1.8 million); 1973: 300 million won ($1.1 million), 1974: 677 million won ($2.5 million); 1975: 300 million won ($1.1 million). Total: 2,553 million won ($9.4 million).

35% Rise Yearly Needed

The Director General of Korean Fisheries Agency emphasized need to increase oyster culture at rate of 35% a year to meet growing demand at home and abroad.

To increase production, 10,000 cho (1 cho equals 2.45 acres) will be developed off southern coast during 6-year period.

1970 Construction

A freezing plant of 600-ton capacity and a cold storage of 150-ton capacity were scheduled to be built in 1970 for 50 million won ($187,000).

1976 Oyster Output

ROK's oyster production in 1976 would total 24,000 metric tons, of which 14,000 metric tons would be exported: 10,000 tons fresh, 2,000 tons frozen, and 2,000 tons canned. ('Suisan Tsushin')

Sanyung Frozen Sea Food Co. in Pusan, S. Korea. FAO reports that fishing industry provides about 85% of annual protein needs of people--and is a major source of foreign exchange. (FAO photo)

EUROPE

NORWAY

FIRST FACTORY SHIP ON FISHING EXPEDITION OFF AFRICA

The Norwegian factory ship 'Norglobal', with 12 purse seiners, is fishing east of Canary Islands. The vessels plan to return to Norway in summer 1971.

The Norglobal has a 24-hour maximum production capacity of 3,000 tons of raw material. Raw material storage capacity equals 40 hours of continuous operation. The pellet storage facilities can hold about 10,000 metric tons; fish-oil storage capacity is about 2,400 tons.

Independent of Ports

The vessel can load and unload supplies in the open sea and so is independent of ports. The crew numbers 60.

Operating conditions and availability of fish will be decisive factor in determining how long to fish.

The vessel is seeking horse-mackerel.

Its Owners.

The Norglobal, 26,500 deadweight tons, is owned by Sigurd Herlofsen and Co., Oslo, and 7 fishing-boat owners from North Norway. ('Fiskaren', Nov. 19, 1970.)

DENMARK

FAROE ISLAND FISHERY EXPORTS INCREASED 53% DURING 1970

Final figures on 1970 Faroese fishery exports were expected to set a record. During the first 9 months, the value of exports was \$22.8 million--more than 53% above \$14.8 million during 1969 period. Over 95% of these exports were products bought mostly by Italy (saltfish) and the U.S. (frozen fish).

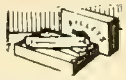
U.S. Agents

To increase exports to North American market, the Faroese Fish Export Central in Thorshavn, "Føroya Fiskasøla," is cooperating with large Icelandic sales firm in U.S., the Coldwater Seafood Corporation, which will represent Faroese producers.

Coldwater's shareholders are all Icelandic producers who belong to Icelandic Freezing Plants Corp. in Reykjavik; the latter has 60-70 fish filleting factories as members in Iceland. Corporation exports of frozen fishery products are being handled by Coldwater, which has established a strong sales organization during the last 70 years. Exports to the U.S. during 1970 were expected to reach US\$50 million.

To Meet U.S. Demands

Up to now, Faroese producers have only exported filleted cod and haddock in blocks to U.S., but they will begin to ship individual consumer packs in various sizes to meet demand of U.S. housewife at supermarkets. ('Politiken', Dec. 15, 1970.)



UNITED KINGDOM

NEW FISH-LABELING REGULATIONS SCHEDULED FOR 1973

Fish-labeling regulations originally slated for the U.K. in 1970 will not be put into effect until 1973.

Requirements for salmon and tuna are of specific interest to U.S. exporters. The fish must be "appropriately designated" according to species. Only Thunnus and Neothunnus will qualify for labeling as tuna. Other species will have to be named specifically: albacore tuna, skipjack tuna, and bonito tuna.

Labeling Salmon

Similarly, only Salmo salar will qualify for straight salmon labeling. Other species will have to be designated as cherry salmon, pink salmon, chinook salmon, sockeye salmon, or as otherwise specified.

The U.S. Embassy in London is looking into the labeling provisions under the Fish and Meat Spreadable Products Regulations 1968 to see how these will affect U.S. exports of flaked and chopped salmon and tuna. (U.S. Embassy, London, Dec. 21, 1970.)

WEST GERMANY

WEST GERMANS DEBATE IMPORT OF HERRING FROM EAST EUROPE

Herring imports from eastern Europe are dividing the W. German fishing industry. Processors want cheaper imports, but fishermen's associations complain about unfair competition. The "war" was being fought in press releases, reported the fishing journal 'Allgemeine Fischwirtschaftszeitung' on Oct. 9, 1970.

The Processors' Association claims it is impossible to operate with herring prices up as much as 15-20%. It criticizes "protective measures" that make it impossible to import "good and cheap herring" from East Europe. Only by "mixed" prices--prices reflecting cheap E. European herring and more expensive domestic herring--will herring consumption in W. Germany remain high.

Alarm About More Imports

The Fishermen's Association provides about half the raw herring needed by German processors each year. It complains about "dumping prices" of Eastern imports. These prevent normal planning. Increases in imports at much low prices might even endanger industry's profitability.

The journal noted that herring imports from East Europe were substandard quality by West German standards. It warned against excessive reliance on "East Bloc" imports that were sensitive to political developments. This referred to Soviet pressure on Iceland in early 1950s, when former refused to buy herring because Iceland had joined NATO; this almost collapsed the entire Icelandic industry.

The W. German industry obtains about 30% of its annual herring catch from Georges Bank (in 1969, 72,000 metric tons of 253,000 tons caught in ICNAF area). If E. European imports depress herring price, it may become prohibitive for W. Germany to fish so far away. Its attention might turn then to North Sea grounds, especially if resources there improve.

USSR

FISHERMEN CLAIM SOVIET-BUILT STERN FACTORY TRAWLERS ARE DEFECTIVE

A new series of trawlers specially designed and built in the Soviet Union for tropical and Antarctic seas is totally inadequate to its task, according to a recent article in 'Pravda'. The article was sparked by a letter from three crew members of the new trawler 'Pioner Latvii'. They complained that on a short trip it was impossible to attain the planned catch quota. They criticized the official who ordered mass production of the series. The design did not correspond to modern requirements and the equipment was defective, they charged.

The Charges

The design was presented by the Leningrad firm, MORPROMSUD, which "tried to stuff heavy, untested, and poorly assembled equipment into the hull of an old design." The vessel was put into mass production despite considerable expense, bother, and disputes. The cost overruns on the Pioner Latvii and her successors, 'Volzhanin' and 'Sakelkhard' ran to 50% of original estimates.

Defects

The automatic equipment does not correspond to designers' concepts, fishermen's requirements, nor to Soviet technical standards. The designers under P. Tkachev created an automated, self-refrigerating unit. No specialized enterprise was brought in when these refrigeration units were designed. The Ministry of Shipbuilding entrusted job to Black Sea shipbuilders. They installed units into 3 vessels without tests. "The refrigerators do not freeze the fish. . .they heat them," complained Pravda.

Bags of fish meal stacked outside Peruvian factory. (FAO)

LATIN AMERICA

PERU

FISHMEAL OUTPUT ROSE

Peru produced a record 2.3 million short tons of fishmeal in year ending Sept. 30, 1970. This was increase of 437,000 tons, 23%, over same period 1968-69.

The increase reflected large improvement in average meal extraction rate and expansion of total catch by 6% to record 11.7 million tons.

1969-70 Exports Down

Exports in 1969-70, just over 2 million tons, were down 7%. The volume was equivalent to 125 million bushels of soybean protein, 9 million fewer than in 1968-69. Most of reduction was reflected in smaller movement to U.S.

Fishmeal Production & Exports

Year beginning Oct. 1	Fish Catch	Extraction Rate	Fishmeal Prod.	Fishmeal Exports	Residual
	Million Short Tons	Percent	(Million Short Tons)		
1964-65	8.3	18.6	1.55	1.57	-.02
1965-66	8.8	18.5	1.63	1.30	+.33
1966-67	9.0	17.7	1.59	1.55	+.04
1967-68	10.8	21.0	2.27	2.11	+.16
1968-69	11.0	17.1	1.88	2.28	-.30
1969-70	11.7	19.8	2.32	2.03	+.29
1970-71 1/	12.0	19.5	2.34	-	-

1/Projected.

These data come from 'Foreign Agriculture', published by U.S. Department of Agriculture, Dec. 21, 1970.

Magazine's Assessment of 1970-71 Outcome

Although it is early to attempt assessment of final 1970-71 outcome, the magazine cautions, it makes these observations:

(1) Total tonnage of landed anchovy has increased every year since 1962-63 by average volume of over 700,000 tons. Annual increases ranged from 200,000 to 1,800,000 tons.

(2) The average meal extraction has been erratic within a range of 17 to 21%. To a large extent, the extraction rate is subject to seasonal variations in uncontrollable fishing conditions.

(3) Upgrading of fish-processing equipment to include evaporators for recovery of fish solubles could, potentially, increase overall extraction rate by at least 10%.

(4) In 1969, the Peruvian industry added 75 new catcher boats. An even larger number was being added in 1970.

(5) Assuming no substantial reduction in 1971 year-class of anchovies, it seems likely that 1970-71 catch will increase somewhat. The widely varying extraction rate may be estimated at slightly above average rates of last 3 years. So production might approximate last season's record volume.

(6) Available exports, including stocks, will rise--perhaps near 2.7 million tons, or 270,000 above year earlier. Estimated increase in supplies would be equivalent to about 18 million bushels of soybean protein.

INDEX

☆ U. S. GOVERNMENT PRINTING OFFICE : 1971 435-339/7

BACK COVER: Thousands of miles from Alaskan cover girl, these men are catching tuna.

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COMMERCIAL FISHERIES Review

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DEPARTMENT
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Atmospheric
Administration

National
Marine
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U.S. DEPARTMENT OF COMMERCE
Maurice H. Stans, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. Robert M. White	Howard W. Pollock	John W. Townsend, Jr.
Administrator	Deputy Administrator	Associate Administrator

NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: Unloading catch from a dugout canoe in Dahomey.

Until recently, lagoon fishing supported about 100,000 people. But deterioration of this source has forced fishermen to go to sea. They have been helped by FAO project involving use of outboard motors on their canoes. These enable them to seek out previously inaccessible offshore grounds. (FAO: G. Tortoli)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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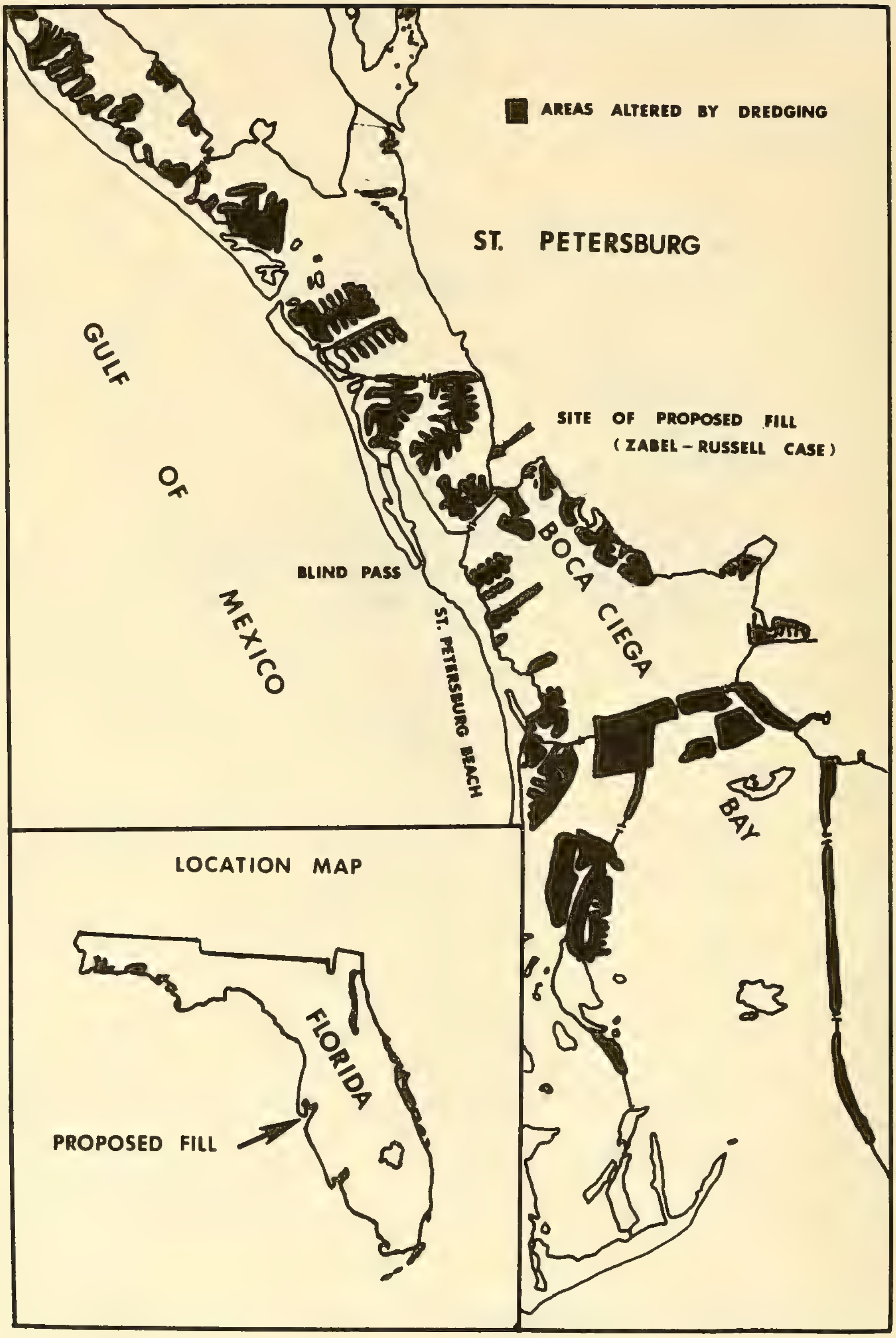
CONTENTS



Prepared by NMFS St. Petersburg Beach Laboratory

SUPREME COURT UPHOLDS ARMY ENGINEERS' VETO OF FLORIDA DREDGE PLAN

In a landmark decision that cheered conservationists, the U.S. Supreme Court, on Feb. 22, 1971, upheld the right of the U.S. Army Corps of Engineers to deny a permit for dredging and filling in navigable waters if the work threatens to injure fish and wildlife. The court action climaxed nearly 12 years of litigation on the Zabel-Russell project in Boca Ciega Bay, near St. Petersburg, Florida. A lawyer for the private interests said: "This is the end of the line. There is no more Zabel-Russell fill proposal."

Background of Case

The controversy began in 1958 when D.H. Russell and A.G. Zabel applied for dredge and fill permit. They had developed the Causeway Village trailer park on land they owned on Boca Ciega bayfront in S. Pasadena, southwest of St. Petersburg. They wanted to create an $11\frac{1}{2}$-acre island in the bay west of their trailer park. They planned to get the fill they needed for the island by dredging the bay. Connected by a bridge to the mainland, the island would become an extension of the trailer park.

Conservationists Oppose Plan

Conservationists organized quickly to resist the plan. For years they had criticized the Corps of Engineers for damaging the environment with unneeded landfills, reclamation of wetland, and alterations of stream channels.

Local and national conservation groups were backed by Interior Department's Bureau of Sport Fisheries and Wildlife, the Florida Department of Natural Resources, some Florida legislators, and the Pinellas County Commission.

Playing important background roles were biologists of the NMFS St. Petersburg Beach Laboratory under Jim Sykes, and Ed Arnold, Chief of NMFS Southeast Region's Office of Water Resource Studies. The biologists had been studying Gulf Coast estuaries for years. They concluded that land fills already caused an annual loss of $1.4-million in fishery products in Boca Ciega. When the Engineers asked their opinion, they voted no.

In 1967, the Corps of Engineers, after asking and receiving the opinions of several government agencies, denied the permit. In that year, U.S. District Judge Ben Krentzman of Tampa reversed the denial.

On July 17, 1970, the U.S. 5th Circuit Court of Appeals in New Orleans, Louisiana, overturned Judge Krentzman's decision.

The Appeals Court noted that the permit application would have been granted several years ago when the Corps of Engineers dealt only with navigation. But, the court emphasized, that was "before man's explosive increase made all, including Congress, aware of civilization's potential destruction from breathing its own polluted air and drinking its own infected water and the immeasurable loss from a "Silent Spring"-like disturbance of nature's economy."

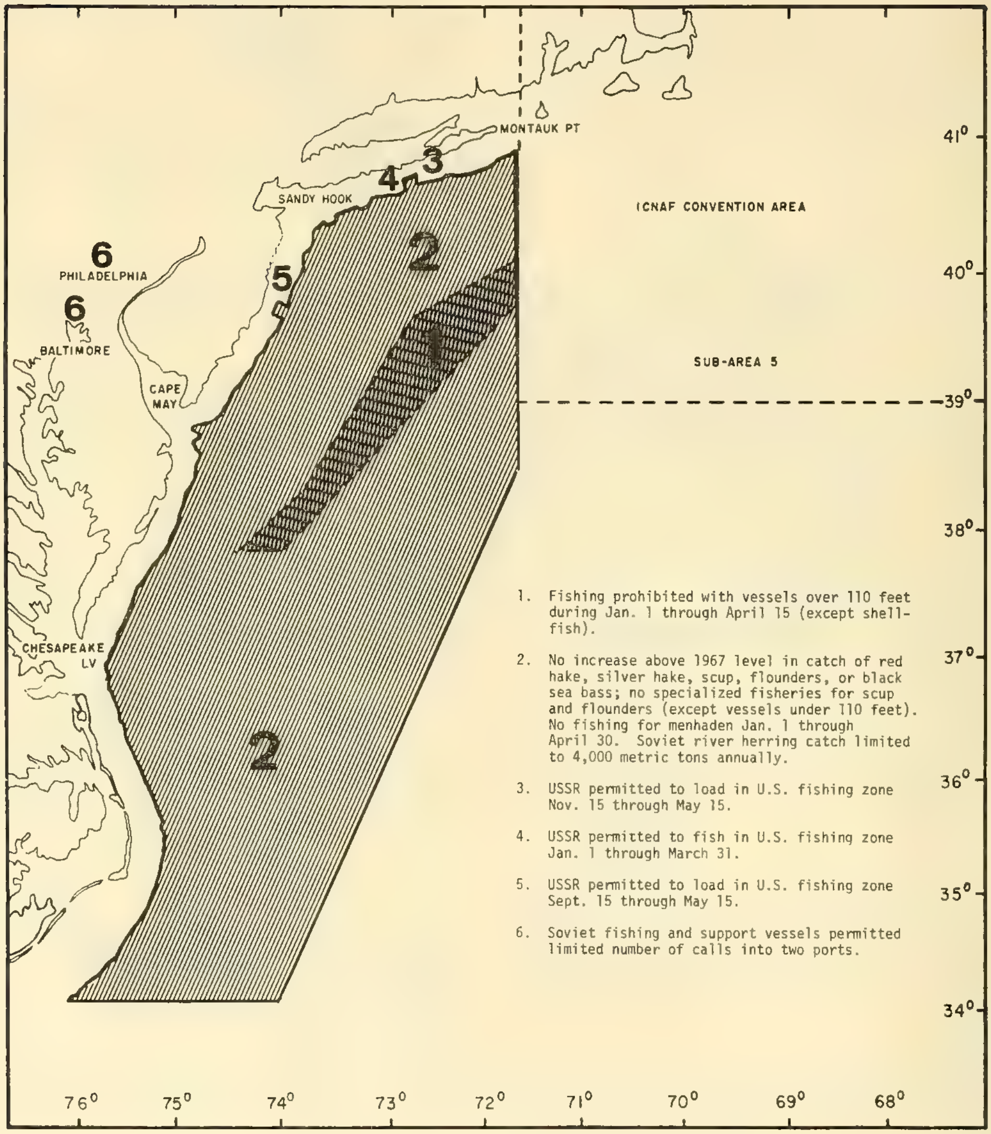
Now the engineers are bound by the National Environment Policy Act of 1969, the Court held, even though the Act was not on the statute books when the Russell-Zabel case was first heard.

On Feb. 22, 1971, the U.S. Supreme Court refused to hear an appeal from the decision of the U.S. 5th Circuit Court of Appeals--thus ending the long controversy.

A Commerce Department official called the decision "one of the most significant judicial decrees ever to affect conservation of natural resources."

U.S.-SOVIET FISHERIES AGREEMENT

effective Jan. 1, 1971



U.S. & USSR SIGN MID-ATLANTIC FISHERIES AGREEMENT

On Dec. 11, 1970, the U.S. and the Soviet Union signed an agreement in Washington on fisheries off the U.S. Middle Atlantic coast. It took effect Jan. 1, 1971. An addition to the agreement was signed Feb. 2, 1971. The area covered extends roughly from west of Block Island in north to Cape Fear (North Carolina) in south.

The agreement extends and modifies U.S.-USSR Mid-Atlantic agreements of 1967 and 1968.

The new agreement affords greater protection for 4 species important to U.S. sports and commercial fishermen. It extends conservation measures to 3 more species.

Provisions of Agreement

In northern part of agreement area, protection was increased for red hake, silver hake, scup, and flounders, species previously covered under U.S.-USSR agreement. Protection was extended to black sea bass, important to U.S. sports fishermen.

A specified offshore area (see map), closed to large vessels from Jan. through March under 1968 agreement, will now be closed Jan. 1 through April 15. The area is on high seas well outside U.S. jurisdiction. The closure protects vulnerable winter concentrations of scup and flounders. It ensures access of red and silver hake to spawning grounds. The added two weeks' protection comes at a very critical spawning period, say U.S. scientists who participated in the negotiations. It is a significant limitation on Soviet fishery.

Significant Changes

In southern part of agreement area, said Ambassador Donald L. McKernan, head of U.S. delegation, two significant changes are valuable to U.S. fishing interests:

"First, the southern boundary . . . has been extended approximately 75 miles from Cape Hatteras almost to Cape Fear. Vulnerable stocks of fish which are of great value to the American fishermen in this area will now be subject to conservation regulations. In the absence of this Agreement, Soviet fishermen would be free to fish for any species in any quantity, for Soviet law permits controls over their fishermen only pursuant to such international agreements."

Second, menhaden, the largest U.S. fishery in Mid-Atlantic, is now covered. "Offshore fishing for menhaden will be prohibited during the months of January through April. During these months the menhaden spawn offshore. This limitation will ensure that the stock will reproduce and return to the inshore area where it is subject to the U.S. fishery during other months of the year."

In the addition to the Agreement, Feb. 2, 1971, the Soviets agreed to limit their catch of river herring to 4,000 metric tons a year.

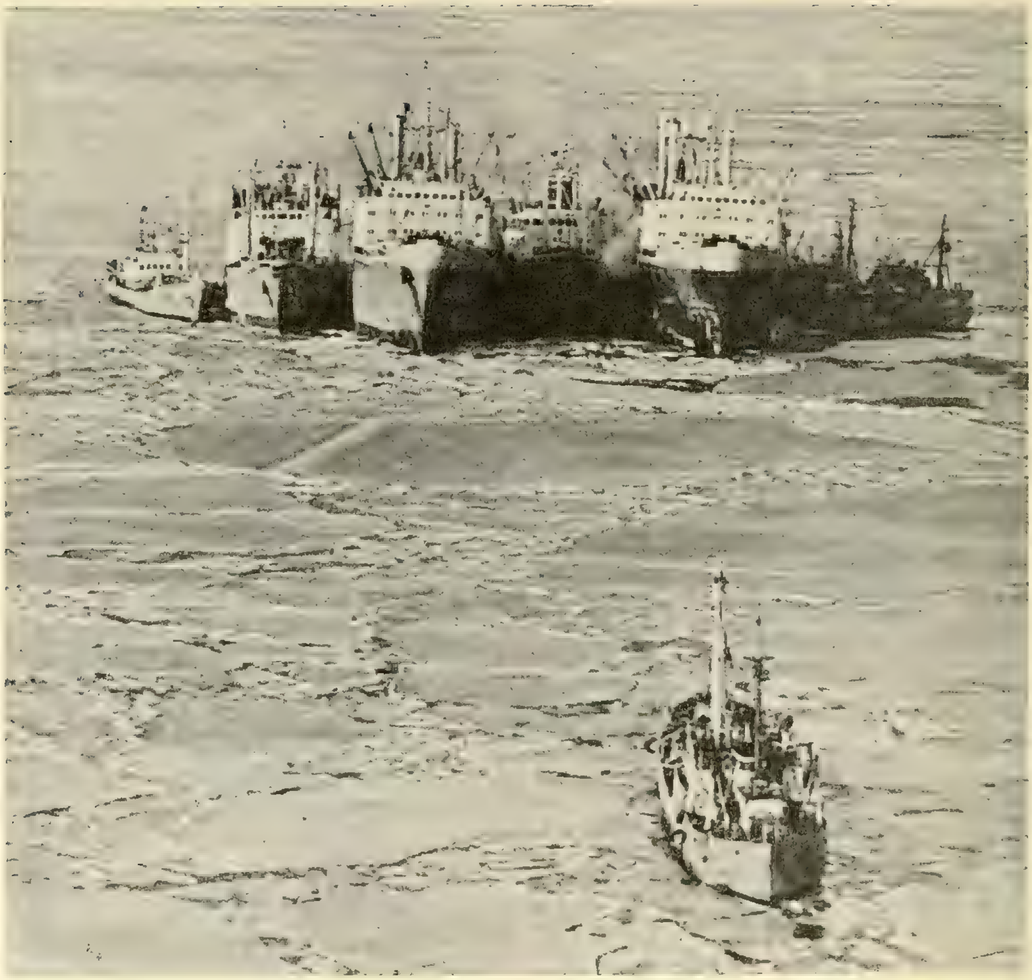
The two delegations also agreed that there is an urgent need to adopt conservation measures in the Mid-Atlantic for the depleted sea herring.

Soviets Allowed Loading Areas

The Soviet fishing fleet will continue to be allowed to use for loading 2 small areas within the U.S. 9-mile contiguous fishing zone off New Jersey and Long Island. Also, the U.S. will permit the Soviets to fish in a small area off Long Island during specified periods during the winter. In addition, in return for Soviet cooperation in conserving species of special concern to U.S. fishermen, entry by Soviet fishing vessels into certain U.S. ports was made easier.

The new agreement is for 2 years. It can be amended any time, as contemplated for river herring and sea herring, or even be renegotiated.

The U.S. delegation included Federal, state, and local experts. The Soviet was led by First Deputy Fisheries Minister V.M. Kamentsev. (U.S. State Dept., Dec. 11, 1970, and Feb. 2, 1971.)



Far from stormy seas, 7 Soviet vessels--motherships to medium side trawlers--nest together to transfer fish and cargo. Another side trawler approaches to make delivery. The vessels belong to Soviet herring fleet, which was operating near St. Matthew Island in Bering Sea. Fleet was anchored 30 or more miles from ice. It is common practice for ships to take shelter from seas and icing conditions by running inside the ice. All Soviet vessels in this winter fishery are reinforced for travel in pack ice. (Photo: M. C. Zahn, Dec. 31, 1969.)

U.S. & USSR SIGN 3 AGREEMENTS

The U.S. and the Soviet Union signed 3 agreements on Feb. 12, 1971, relating to northeastern Pacific fishery problems. The agreements, which replace three previous ones, became effective immediately and will remain in effect for 1971 and 1972. They were signed by U.S. Ambassador Donald L. McKernan and Vladimir M. Kamentsev, Soviet Deputy Minister of Fisheries.

I. Eastern Bering Sea Crab Fisheries

It was agreed that the Soviet harvest of king and tanner crabs be reduced to 23,000 cases of canned crab (56% reduction in quota) and 35,000 cases of canned tanner crab (12.5% reduction in quota). Also, the legal minimum size of harvestable male king crabs was increased from $5\frac{3}{4}$" to $6\frac{1}{4}$". However, the Soviet representatives stated that they would take no more than 12,800 cases of king crab of their quota of 23,000 cases. It was agreed that, in view of this catch level, the increased minimum size limit would not apply to Soviet fishermen in 1971 and 1972.

Also, the Soviet Union will reduce amount of tangle net gear used to capture crabs in 1971 and 1972. She will emphasize development and use of pot gear used by U.S. fishermen. The sanctuary where only crab pots may be used will be retained. This area is closed to trawling to prevent conflicts arising from the use of stationary instead of mobile fishing gear.

The two other new agreements provide improved protection for stationary fishing gear to conform to king crab and tanner crab fishing season in areas westward along Aleutian Islands and in Gulf of Alaska near Kodiak Island. The period closed to mobile gear in 3 of the 6 areas off Kodiak was extended by $3\frac{1}{2}$ months.

To reduce conflicts between trawl fishermen and halibut fishermen, special measures are provided for 3 main halibut fishing grounds in eastern Bering Sea and 3 areas in Gulf of Alaska--including a closure to mobile gear during beginning of halibut fishing season.

II. Off Washington, Oregon, California

The existing 6 areas on high seas established to protect Pacific Ocean perch and other species of rockfishes were expanded seaward from 450-meter depth to 600-meter depth.

The period in which trawling will be prohibited during winter months in these 6 areas when perch and other shelf rockfishes congregate also was increased by 15 days.

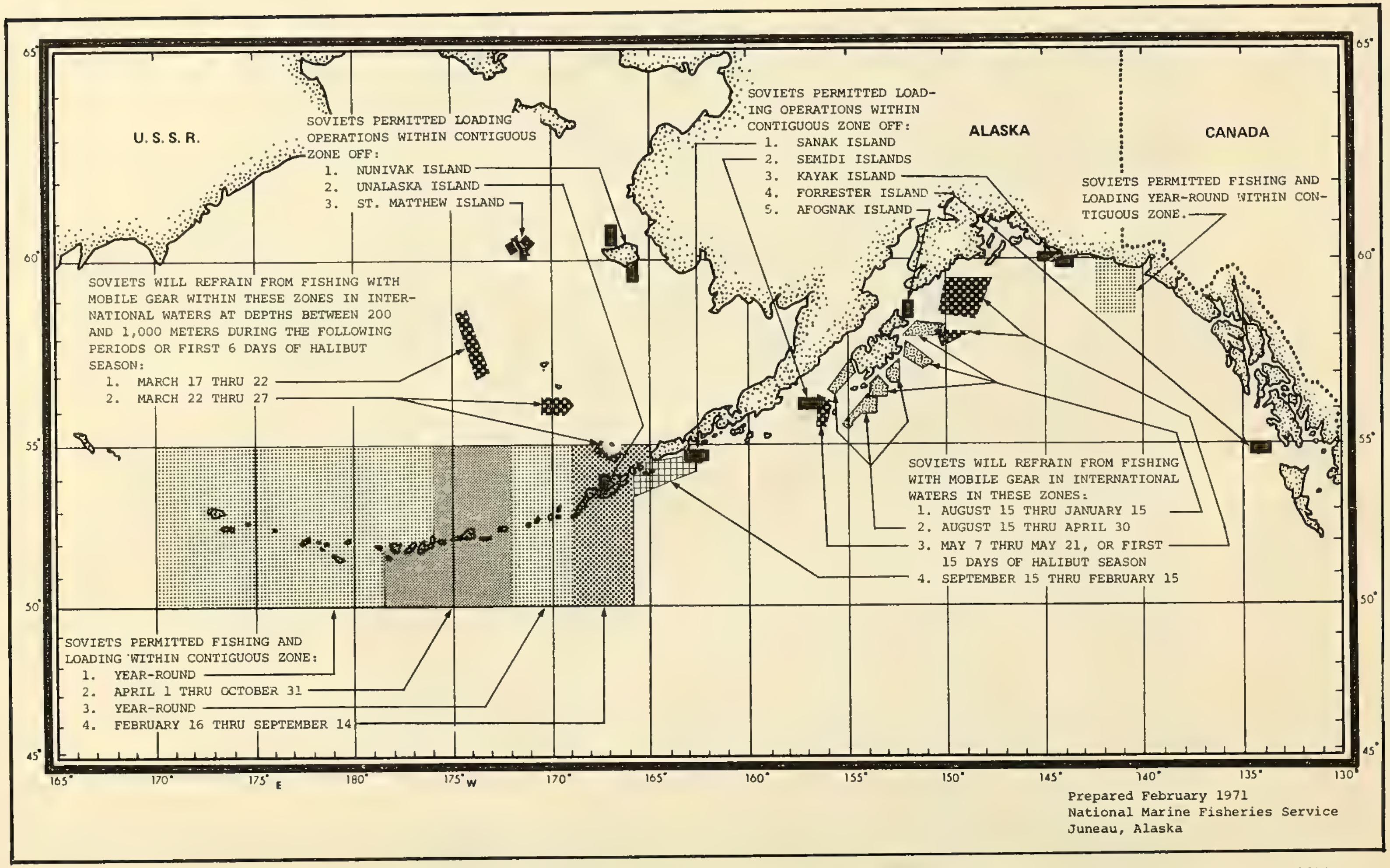
It was agreed that other measures--use of trawl nets of certain mesh sizes, avoidance of areas of rockfish concentration, catch limitations--would be implemented to provide increased protection for these resources.

III. 3-12-Mile Zone In Aleutians

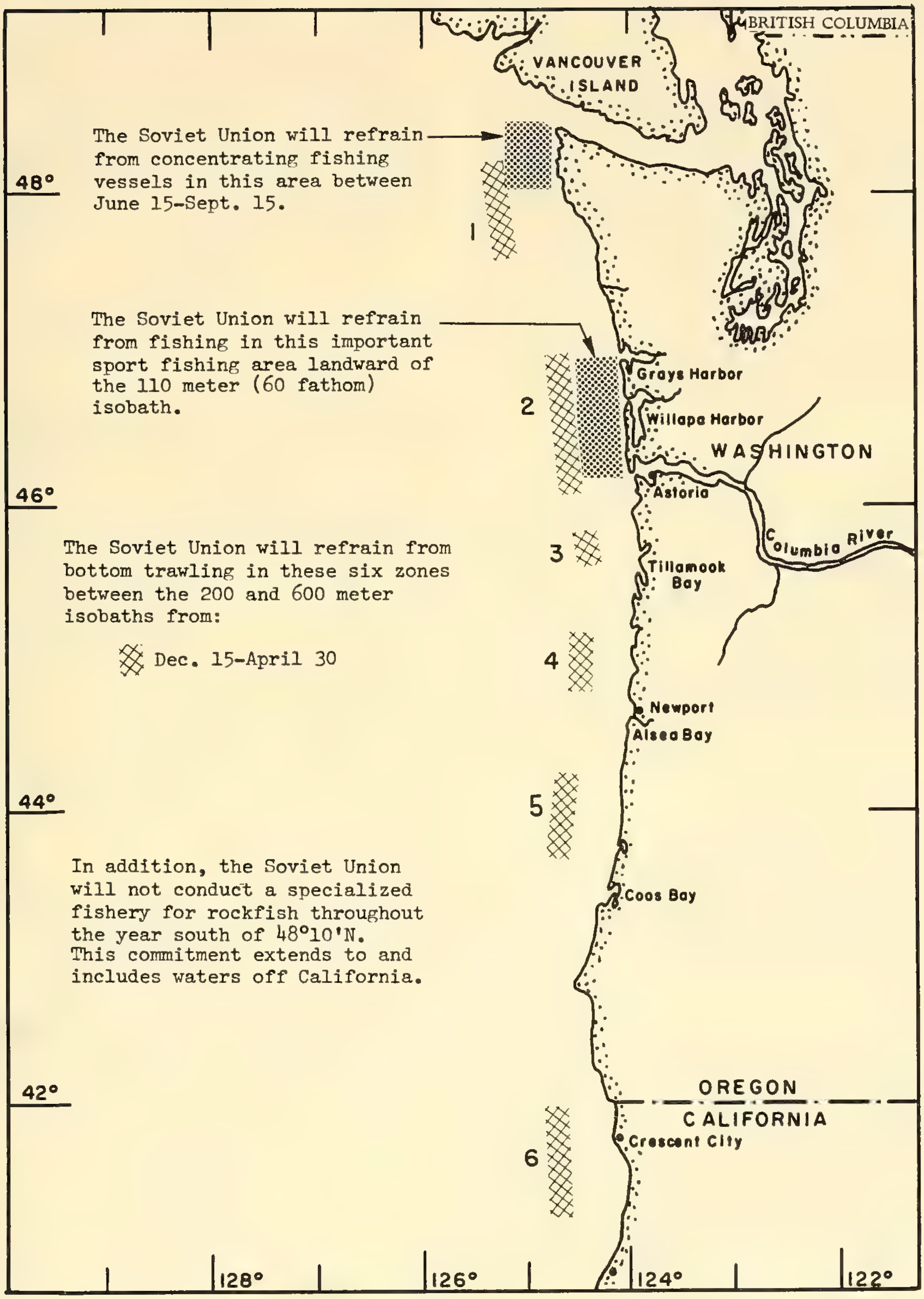
In return for concessions on high seas granted to U.S., the USSR will be permitted to continue fishing for finfishes in 3- to 12-mile zone in Aleutian Islands when U.S. crab fishermen are not operating there. Also, the Soviets will be able to load and transfer in U.S. contiguous zone in 3 new localities: Semidi Islands in Gulf of Alaska, and St. Matthew Island and Makushin Bay in Bering Sea. Soviet fishing and support vessels will be permitted to make up to 4 calls per month at Pacific Coast ports of Seattle, Wash., and Portland, Oregon.

The new agreements provide for cooperation in fishery research on fish stocks of mutual concern and exchange visits to fishing vessels.

The U.S. delegation also included advisers from state fishery agencies and commercial and sports fisheries of Alaska, Washington, Oregon, and California.



U.S.-USSR Fisheries Agreements Concerning the U.S. Contiguous Fishery Zone Off Alaska, February 1971.



U.S.-USSR Contiguous Fishery Zone Agreement (Pacific NW Area) - February 1971.

YELLOWTAIL FLOUNDER IN SERIOUS DECLINE

NMFS Woods Hole scientists estimate that the yellowtail flounder populations off New England could support a sustained yield of 21,000 to 34,000 metric tons (MT) per year. In recent years, the catch has ranged from 43,000 to 58,000 MT. This increased catch has resulted largely from increased fishing pressure combined with some above-average year-classes. The heavy fishing has reduced abundance of stocks and shifted population from older, larger fish to fish just entering catchable size range. Recent research cruises by NMFS 'Albatross IV' have found no evidence of strong entering year-classes--and a decrease in total stock.

Catch Must Be Reduced

The meaning of all this, says NMFS Northeast Region, is that catch must be reduced to build up spawning stocks. The probability of good year-classes is much higher when spawning stock is large. A reduced spawning stock lessens chance for recovery. To help recovery, the International Commission for the Northwest Atlantic Fisheries (ICNAF) has adopted a 1971 quota of 29,000 MT. The quota has to be ratified by the nations involved.

Many Fish Discarded

Another factor in this fishery is that many fish are caught and then are discarded because they are below marketable size. In recent years, about 10,000 MT of the catch have been discards. The fish do not survive in significant numbers after being discarded.

A larger mesh size for the nets would permit these fish to escape being caught, and allow them to grow to catchable size. A 5.1-inch mesh size has been recommended by NMFS scientists. This should result in an eventual increase of the harvest by 10% over current 4.15-inch mesh. The increase would occur only after the population had a chance to build up. An even larger mesh size would have greater long-term gains but would result in higher immediate losses in catch.

Management Measures Necessary

If management measures are not taken, NMFS Northeast cautions, the once-important yellowtail flounder may decline to where it may no longer be viable. Management measures begun now could halt this decline and permit the population to support a sizable sustained yield.

NEW ENGLAND LANDINGS & VALUES ROSE IN 1970

Preliminary figures show that 1970 New England landings increased 24% and values 13.5%, reports NMFS Northeast Region.

The landings of 1.3 billion pounds made 1970 the best year since 1966; the $161 million value was the second highest recorded.

An unexpected resurgence of the menhaden fishery, up 280 million pounds, from 225,434,000 in 1969 to 505,182,000 in 1970, was responsible for the increased landings.

The overall improvement in most fish prices brought the value up from $142 million in 1969 to the 1970 level--$161 million.

Otter-Trawl Fishery No. 1

The otter-trawl fishery led in value with $40 million. Lobsters were the most valuable species at $31.7 million.

Surf, soft and hard clams, lobsters, and shrimp hit record values. No finned fish achieved this. Surf clams alone reached record poundage. Haddock alone fell to all-time low.

MONITOR SPAWNING HADDOCK

Since 1968, the NMFS Woods Hole Laboratory (Mass.) has been monitoring each year the spawning condition of the haddock stocks. The stocks are at a very low level. The poor recruitment for the past several years has led to a peculiar age structure: Most of the mature fish belong to the last good year-class and are now 8 years old. It is not known what effect this may have on spawning success.

14,000 Samples

Samples of fish from commercial and research-vessel trips are examined regularly as the spawning season advances and their degree of maturation recorded. Since 1968, over 14,000 haddock have been sampled. Each year the date of peak spawning has been earlier than the year before. One hypothesis is that this results from the increasing average age of the fish. Older haddock usually spawn before the younger ones. Another possibility is that this is a response to a slight warming trend in water temperature over the past few years.

1969 Year-Class Haddock

An interesting sidelight from the first samples examined this year is the presence, about 10% of total, of some haddock from the 1969 year-class. Very few of these fish will spawn this year. They are so small, 34 to 47 cm, that they will contribute little to the total production of eggs. However, their presence may mean that this year-class was underestimated when sampled as young-of-the-year.

NMFS STUDIES HERRING OFF MAINE

Each year, NMFS biologists estimate the winter mortality of larval herring in the Sheepscot estuary (Maine). This is one of the methods used to predict the abundance of immature herring that will be available for canning as sardines along the western coast of the Gulf of Maine. The winter (1970-71) mortality for this year was estimated as 37% for 15 days from mid-December 1970 to mid-January 1971. This was less than a year ago and about average (35%) for the past 7 years. The catch of larvae was much lower than a year ago and below average.

Frenchman Bay

Efforts to estimate the mortality of larvae in Frenchman Bay in the eastern sector of the Maine coast were unsuccessful--by January, no larvae were in the bay. A larvae scarcity in this sector is not unusual in the winter, states NMFS Northeast Region.

No Suitable Area

It appears that an area suitable for determining winter mortality does not exist from Mt. Desert eastward. However, larvae usually are abundant in the eastern sector in the spring; these larvae are thought to originate in waters southwest of Nova Scotia. So, the most appropriate area to determine winter mortality for larvae in the eastern sector of the coast may be St. Mary's Bay on Nova Scotia's southwest coast.

E. COAST DEEP-WATER LOBSTERS TRANSPLANTED IN PACIFIC NW

A feasibility study on transplanting East Coast deep-water lobsters (homarus americanus) to Oregon waters was initiated in December 1969 by University of Rhode Island (URI), Oregon State University, and Oregon Fish Commission. Capt. James McCauley carried out URI's part by supplying more than 500 lbs. of adult lobsters and air-shipping them to Oregon. The lobsters were obtained from the offshore population and consisted of males and berried females. The shipping mortality was less than one percent. Most were judged extremely hardy on arrival in Oregon.

Unfavorable Hydrographic Conditions

Prof. Jeff Gonor, Oregon State Marine Science Center, Newport, Oregon, has informed URI that hydrographic conditions at 100-fathom line do not permit adequate survival of larvae released by berried females. Surface-water temperature off Oregon in spring and summer usually averages around 12°C (about 54°F). which causes exceedingly slow development of larvae. In turn, this results in exposure of larvae to surface and midwater predators for so long a period that entire stock is eliminated.

Other Experiments Promising

However, other experiments with the lobsters have indicated "potentially promising developments" in another area. The seasonal temperature fluctuations of the sea water supply from the bay adjacent to Oregon's Marine Science Center is adequate for adult survival. In fact, summer refrigeration would not be needed for any holding pounds between northern California and Washington.

Thus, says URI, there appears to be merit in considering commercial sales of lobster from holding pounds on U.S. northwest coast. The pounds could be stocked during peak landings on east coast--and might stabilize price to lobstermen at desirable level.

RECORD SHRIMP CATCH SET ON PACIFIC COAST IN 1970

The 1970 shrimp catch along the Pacific coast hit a record 92.4 million pounds, heads on, up 29.9 million pounds (48%) from 1969's record 62.5 million pounds.

The fast-growing Alaskan shrimp fishery soared to record 74 million pounds, heads on, a rise of 26.2 million pounds (55%) from 1969.

Also records were Oregon's 13.4 million pounds and California's 4.038 million.

Kodiak Sets Pace

Kodiak's shrimp landings of 62.4 million pounds were 84% of Alaska's total--and 68% of entire Pacific Coast catch.

COMMERCIAL FISHING COURSE AT BELLINGHAM, WASH.

The Bellingham Technical School in Washington State is conducting a fishery training course designed to prepare persons for work on commercial fishing vessels. The graduates will be able to serve on vessels used for purse seining, otter trawling, gillnetting, reef netting, trolling, and halibut fishing.

The Curriculum

The 10-week course, Feb. 22-April 30, has daily classes--on commercial fishing, orientation on vessel, basic seamanship, navigation techniques and rules, safety rules, marine engines and power equipment, fishing gear, assembling and repairing fishing gear, species of commercial fish and their care and handling.

STUDY EFFECTS OF STARVATION ON SWIMMING OF YOUNG JACK MACKEREL

Drs. John Hunter and Reuben Lasker began an experiment in January 1971 to determine the effects of starvation on the extent and distribution of fat and glycogen reserves, and on swimming abilities, in juvenile young-of-the-year jack mackerel. The work will help determine the likelihood of survival of young-of-the-year juveniles during their first winter--when effects of mortality on year-class strength may be most significant.

The scientists are with NMFS Fishery, Oceanography Center, La Jolla, Calif.

Fish were starved for 45 days and samples taken for biochemical analysis at 5-day intervals. Endurance swimming of the fish was tested at beginning and at end of experiment.

Preliminary Findings

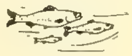
Preliminary analysis of the biochemical data indicates that the fat concentration of the viscera declined about 50% over the 45-day starvation period. Fat concentration in the red muscle, and the total mass of that muscle, declined about 50%. But the fat concentration in the white muscle dropped about 90%, and was nearly undetectable in some samples.

Glycogen concentrations of red and white muscle dropped in first 15-20 days, but then stabilized or decreased only slightly.

The ability of the fish to sustain speed threshold was affected only minimally by the 45-day starvation period. The 6-hour swimming 50% fatigue threshold for starved fish was within the interval 98-121 cm/sec, whereas the controls fell within the interval 121-139 cm/sec.

Fish Adjusted

The juvenile jack mackerel adjusted to a 45-day starvation period by using the extensive fat reserves of the viscera (about 60% its dry weight was fat) and the fat in white muscle (about 11% dry weight of muscle). The ability of the fish to withstand strenuous swimming for extended periods was not greatly affected because they maintained glycogen above critical levels in both white and red muscles.



GENERATIONS OF PLANKTON REARED IN LAB

Dr. Michael R. Reeve has reared planktonic chaetognath (Sagitta hispida) through more than one generation in the laboratory, reports the University of Miami's School of Marine and Atmospheric Science.

The minute, transparent, sea animal was "reared from egg to adult and the second-generation egg stage in 3 to 4 weeks."

Scientists believe chaetognaths are second most important animal plankton in many parts of the oceans. They feed on copepods, the primary animal plankton group that eats plants. S. hispida is common in Florida coastal waters.

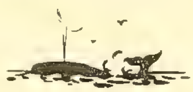
Meaning of Achievement

The school believes that Dr. Reeve's success brings closer the time when interactions of microscopic marine animals and plants--which form base of marine-food production and distribution web--may be seen in miniature laboratory communities.

3,325 WHALES PASS YANKEE POINT, CALIF., IN 67-DAY CENSUS

The annual count of migrating gray whales at Yankee Point, near Monterey, Calif., was completed Feb. 13, 1971, reports NMFS Fishery-Oceanography Center, La Jolla. Robert Strawn and Stephen Treacy counted 3,325 whales moving south past the Point during daylight.

The total gray-whale population--including allowance for whales that passed at night and those missed in periods of poor visibility--was estimated at about 10,000-11,000. The annual counts have remained about the same for the past 4 years; the population size appears "essentially stable".



NMFS BEGINS COOPERATIVE FISHERY-ADVISORY PROGRAM WITH TUNA FISHERMEN

A gray box is being added to the chart-room equipment of San Diego-based tuna purse seiners, which fish for yellowfin and skipjack tuna in the eastern Pacific Ocean. Installed by technicians of NMFS Fishery-Oceanography Center, La Jolla, Calif., the boxes are radio facsimile recording sets. These are able to receive direct oceanographic and weather information on 12- by 19-inch charts transmitted daily by Federally licensed radio station WWD at nearby Scripps Institution of Oceanography.

Environmental Data From Vessels

Dr. Alan R. Longhurst, Director of the Center, explains that this fishery advisory service is being tried experimentally to obtain environmental data from fishing vessels, and to provide fishermen with information that may help them make tactical fishing decisions. He emphasizes that the environmental data collected by fishermen are necessary for use in the Center's development of fishery-forecasting techniques and methods for tropical tunas.

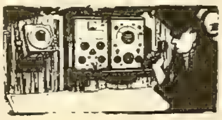
Each day, information on sea-state, including direction and height of swells, and height of wind-waves is plotted onto a chart for transmission to fishermen on the fishing grounds; weekly, an analysis of 7-day sea-surface temperatures is plotted for transmission.

Chart Information

A second daily chart provides information on direction and speed of surface winds, location and direction of movement of tropical storms, and location of areas of squalls and potentially threatening weather conditions.

In the near future, a weekly analysis of mixed layer depths, the depth at which warm surface waters meet cooler waters below, also will be included in the charts.

Eventually, the location of small-scale ocean-surface temperature features as indicated by temperature measures made by orbiting weather satellites and received at the Center also will be added to the charts. The charts cover the American west coast to 140° W., between latitudes 30° N and 5° S. According to Dr. M. Laurs, leader of Fishery-Oceanography Program, who is directing the work, the information on the charts is tailored to needs of fishermen on tuna fishing grounds in eastern tropical Pacific.



OREGON FISH COMMISSION SURVEYS ESTUARIES

The Fish Commission of Oregon began an intensive study of the state's estuaries on March 1. Purpose is to determine how many people use the estuaries, the distribution of these people, and how much of the harvest of fish and shellfish is for personal use. Commission biologists aided by State Game Commission personnel will survey the state from the Columbia River in the north to the Chetco River on the south coast.

Importance of Estuaries

Marine biologists note the importance of estuaries as a rich feeding ground for young fish and shellfish, and as spawning grounds for marine finfish. The biologists are interested particularly in bay clams, an important recreational and commercial shellfish found only in the tidal areas of Oregon's estuaries. Rich nutrients, sheltered waters, and ideal spawning conditions make estuaries unique and vital natural resources.

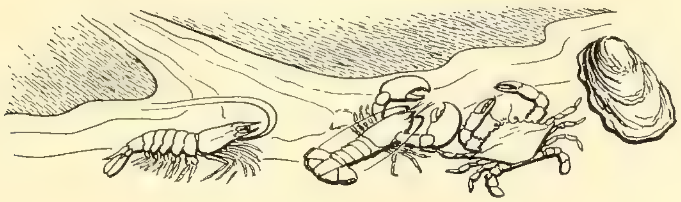
Oregon's estuaries are only 1/10 of 1% of its geographical area, fewer than 56,000 acres in all. All could be placed easily into Willapa Bay, Washington.

Estuaries are under critical pressure from increasing filling, alterations, and development of bay and tideland areas for housing, industry, and highways. Preservation and wise use depend on responsible planning and management, the Commission states.

Public Can Help

Clam diggers and fishermen using Oregon's bays in 1971 have been asked to cooperate with the biologists conducting the resource survey. Their considered answers to questions would produce an accurate reflection of the current use of these bay and river-mouth areas.

Legislation passed in 1969 requires counties to zone their lands by Dec. 31, 1971. The study will be an important guide to city and county planning for the coastal communities. Results will be made available to all agencies planning the protection and enhancement of the state's valuable estuarine resources.



SHELLFISH SITUATION AND OUTLOOK

Richard W. Surdi & Donald R. Whitaker
NMFS Current Economic Analysis Division

Supplies of shrimp available for consumption were a record 541 million pounds, heads-off weight, during 1970. Compared to 1969, supplies of northern shrimp rose 26% to 65 million pounds, while supplies of southern shrimp rose 13% to 476 million pounds.

U.S. landings of shrimp during 1970 were a record 224 million pounds, heads-off weight. Increased landings in the Gulf and the West Coast offset declines in the South Atlantic and New England.

Imports of shrimp rose sharply to 219 million pounds, product weight, during 1970. Each product category of imports rose above the previous year. Imports were again at about 53% of combined total of landings and imports.

In addition to record supplies, consumption was also a record. Increasing about 14%, apparent consumption of shrimp in all forms was 413.7 million pounds, heads-off weight. Northern shrimp sales were 44 million pounds during 1970; consumption of fresh and frozen southern shrimp rose 12% to 339 million pounds, or 95% of total fresh and frozen consumption.

The average price for shrimp landed in U.S. fell to 57.3 cents per pound on heads-off basis. The average wholesale price for 26-30 count raw headless shrimp at Chicago dropped about 4% to $1.26 per pound. The 41-city average retail price for breaded shrimp was $1.63 per pound in 1970--7% above 1969.

About 67.7 million pounds of heads-off shrimp (3.9 million standard cases) were canned in 1970--43% above 1969. Exports of domestic shrimp rose 11% to 40.8 million pounds; exports of foreign-caught shrimp were 14.8 million pounds.

Despite jump in prices during January and February 1971, consumption is expected to be higher than 1970--at about 102 or 103 million pounds for January-April. Canning in Gulf States is expected to total about 800,000 pounds, heads off. Domestic exports of fresh and frozen shrimp may increase slightly to 14 or 15 million pounds in January-April 1971.

January-April 1971 landings in South Atlantic and Gulf are expected to be about equal to 20.6 million pounds in 1970 period. New England landings may decline, but West Coast landings are expected to increase again in 1971.

Despite January decline, imports are expected to rise 2 or 3 million pounds above January-April 1970 to 78 or 79 million pounds, heads off.

The combination of 180 to 182 million pounds of supplies and utilization of 121 to 124 million pounds would result in May 1 stocks of 58 to 60 million pounds--slightly above 56 million pounds on hand May 1, 1970.

SCALLOPS

Supplies of sea scallops in 1970 were 26.1 million pounds. U.S. sea scallop landings of 7.1 million pounds continued the declining trend that began after peak catch in 1961. As abundance has continued to decline, fishing effort has fallen sharply.

U.S. imports of scallops were 16.8 million pounds in 1970--up nearly 18% from 1969. While imports of Canadian scallops declined 10%, substantial increases from other countries more than offset decline.

During 1970, consumption of sea scallops totaled 24 million pounds. Record high prices and low supplies were major factors in this decline. January-April 1971 consumption is expected to slip fractionally from 1970 to a little over 6 million pounds.

January-April 1971 supplies of sea scallops are expected to slip slightly from same period 1970. Landings of sea scallops will probably be lower again this year; the majority of decline is expected in New England. High prices on U.S. market again are likely to spur imports in 1971. Imports during

January-April may increase to about 4.3 million pounds.

Combining supplies of 7.8 million pounds and consumption of 6.2 million pounds would result in about 1.6 million pounds in inventories on May 1.

Total landings of calico scallops were 2.1 million pounds during 1970--up sharply from 183,000 pounds landed during 1969. Most of 1970 catch was landed in North Carolina, which reported 1.8 million pounds.

NORTHERN LOBSTERS

Supplies of northern lobsters during 1970 dropped about 4% from 1969 to 60.6 million pounds, live weight. U.S. landings of northern lobsters were estimated to be 30.4 million pounds--also down 4% from 1969. All of the decline in landings occurred in Maine, which fell about 8% from 1969. A decline in pot fishery was partially offset by increases in the otter trawl and other fisheries.

At 19.5 million pounds (product weight), imports of Canadian lobsters were 5% below 1969 total. All three categories of live, canned, and cooked meat were below previous year.

Demand for northern lobsters continue strong throughout 1970. With supplies slipping somewhat, the high level of demand caused prices to set records.

Supplies of northern lobsters in first 4 months of 1971 are expected to decline slightly from 1970. Preliminary data indicate that Maine landings in January were running below 1970. Imports are also expected to decline.

Declining supplies and continued high demand during January-April likely will result in higher prices than in 1970.

SPINY LOBSTER TAILS

Supplies of spiny lobster tails of 40 million pounds were 6% below record available in 1969. Record-high beginning inventories were more than offset by a 4.8-million-pound drop in imports.

Imports of lobster tails fell 13% to 32.5 million pounds. The share of U.S. market held by cold-water tails continued to slip during 1970; that of warm-water tails rose correspondingly.

Inventories generally declined from a record of 7.5 million pounds on Jan. 1, 1971.

Apparent consumption of spiny lobster tails was a record 35.7 million pounds. This increase was possible because of reductions in inventories. As price rose above 1969's during the last 4 months of 1970, sales dropped off.

January 1970 wholesale prices for 6- to 8-oz. cold-water lobster tails were 81 cents below the previous year. That price rose to a record in November of $4.00 per pound.

Conditions in January 1971 pointed to increase in imports during first 4 months. The level of prices in January, however, appeared prohibitive to greatly increased consumption. If imports rise sharply, prices may dip somewhat from January level.

WEST COAST CRABS

Supplies of West Coast crabs (king, dungeness, and snow) were about 138.5 million pounds, live weight, in 1970. Lower inventories of frozen crabs and imports offset an increase in landings.

West Coast crab landings were 123.4 million pounds, live weight, during 1970. Dungeness-crab landings increased for 6th consecutive year to record 57.2 million pounds. The snow-crab fishery in Alaska rose to 15.2 million pounds, while Alaska king-crab landings declined 12% to 51 million pounds.

During 1970, demand for king and dungeness-crab products improved, but it weakened for snow crabs. Prices for most crab products were below 1969's.

King-crab landings in 1971 may drop below 1970. This would resulted in some crab vessels switching to other fisheries. Although prices of imported canned king crabs are currently (mid-March) below domestic price, some upward pressure may develop if landings are again low in 1971. Dungeness-crab landings may expand somewhat in 1971. But heavy merchandising will be necessary if snow-crab industry is to grow during the year.

THE CHESAPEAKE BAY ROCK CRAB

Dr. Paul A. Haefner Jr. & Roy T. Terretta

Scientists in VIMS' Department of Crustaceology are currently investigating certain aspects of the biology of the rock crab, Cancer irroratus (Fig. 1), in light of its potential for a Chesapeake Bay fishery.

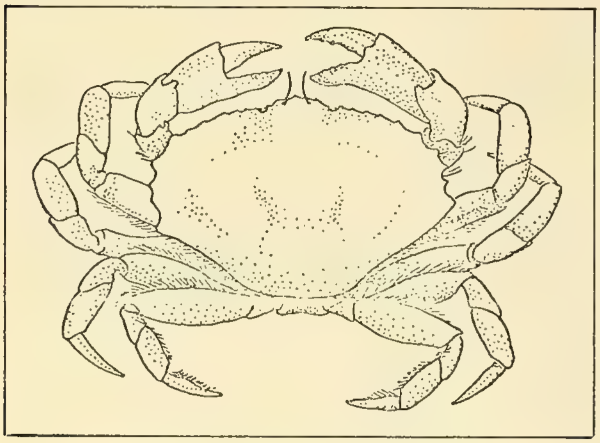


Fig. 1 - The rock crab, Cancer irroratus.

The rock crab ranges from Nova Scotia to the South Atlantic States. Known locally as "stone crab", it should not be confused with Menippe mercenaria, the true stone crab (Fig. 2), which has a southern distribution.

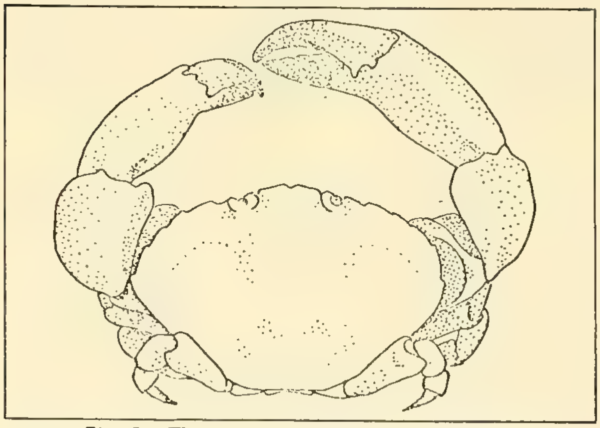


Fig. 2 - The stone crab, Menippe mercenaria.

The rock crab is most abundant along the New England coast where it is the main source of edible crab meat. There is no large commercial fishery in that area primarily because of competition from the lobster industry, but there is no other reason why this crab could not be utilized as a food source. Large crabs reach 6 inches in width and contain a large quantity of meat, especially in the claws. The flavor equals that of the blue crab.

Chesapeake Is Southern Limit

Chesapeake Bay is within the southern limit of the range of the rock crab, a fact obvious from their presence in the catch of the winter dredge fishery for blue crabs. Here rock crabs are now culled and discarded. Some areas of the bay are avoided by dredgers because of the preponderance of rock crabs over blue crabs.

Rock crabs of the lower Chesapeake Bay may be utilized four ways: 1) as picked crab meat; 2) as whole, fresh, or steamed hard crabs; 3) as peeler crabs to shed into soft crabs during the winter months; and 4) as peeler crabs for fishing bait.

Captains Aid VIMS

Virginia dredge-boat captains have been especially helpful by taking VIMS scientists with them during dredging for blue crabs, which began November 30, 1970. First-hand

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information has been obtained on the distribution and abundance of rock crabs compared with blue crabs, on the ratio of male to female rock crabs, on their average size, and whether they are hard, soft or papershells.

Where They Are

Most rock crabs caught in the dredge fishery of Chesapeake Bay are males and may be distinguished from the females by the shape and size of the abdomen or "apron" (Fig. 3). The crabs have been more abundant east of the Chesapeake Bay Bridge Tunnel and are usually found on hard bottom. Above the bridge tunnel, they appeared to be more common on the eastern side of the bay.

Hard crabs have been kept alive and healthy for more than a month at the Institute in indoor tanks supplied with running seawater. Soft crabs have also been produced, particularly during January, when a large percentage of the rock crabs caught have been peelers.

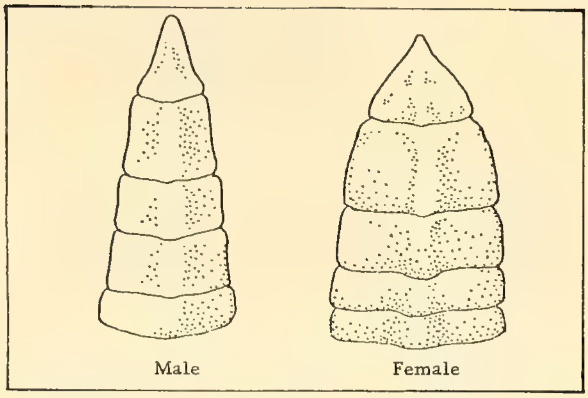
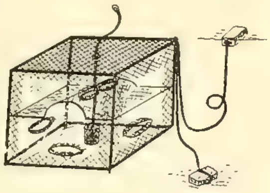


Fig. 3 - The shape of the abdomen or "apron" of the male and female rock crabs.

Soft rock crabs are "fatter" than soft blue crabs--for any given width, rock crabs weigh substantially more than blue crabs. Four- and 5-inch-wide blue crabs may weigh 2 to 4 ounces, whereas the same size rock crabs weigh $4\frac{1}{2}$ to 10 ounces. If sold by weight, soft rock crabs would bring a higher market price than their blue crab counterparts.



AMERICAN SAMOA GETS FISHERY STATISTICAL ANALYSIS PROJECT

The Government of American Samoa has established a project to collect and monitor fishery statistics under the Federal Aid Program administered by the National Marine Fisheries Service (NMFS), reports Edward E. Hueske, Chief, Division of Federal Aid. The $2\frac{1}{2}$-year project requires $21,000 in Federal funds.

Dr. Stanley N. Swerdloff, Supervisor of Marine Resources, Government of American Samoa, will supervise collection of catch and effort data, and biological data on principal species landed by longline fishery. Data will also be collected on the small inshore subsistence fishery.

Longline Fishery

The longline fishery based at American Samoa, the most important private enterprise, is conducted through the cooperation of U.S. and foreign firms.

In 1968, the two canneries processed 29,000 metric tons of tuna worth about $10.6 million to the fishermen. Nearly 1,000 American Samoans are employed. Tuna canning fosters other businesses, which contribute significantly to the islands' economy.

Monitoring Fishery Revived

Until recently, the Hawaii Area Fishery Research Center (HAFRC) of the National Marine Fisheries Service maintained a field station at American Samoa to monitor this longline fishery. Its purpose was to assess effect on the important tuna resource of the South Pacific. Budgetary limitations forced discontinuation of its operations at Pago Pago. Under the new arrangement with the Government of American Samoa, HAFRC will be able to continue its work.

Data Collecting Valuable

Despite the large tuna fishery based in Pago Pago, fresh fish appear in the markets only sporadically and in small quantities. The extent of the subsistence fisheries in the villages of American Samoa is not known.

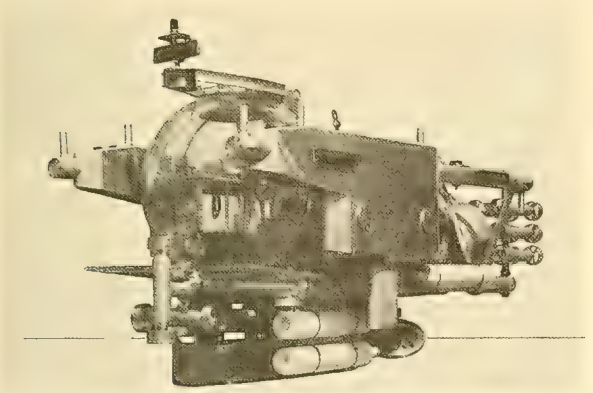
The Government of American Samoa, under the Federal Aid Program, is endeavoring to develop additional fisheries that can be operated wholly by Samoans. Thus, a data-collecting system begun early in this program should produce information vital to effective management of the developing fishery.

Data on the longline fishery will be forwarded to HAFRC for processing and analysis. This will allow a continuing determination of tuna-resource status in the South Pacific. Data on the subsistence fishery will be processed and analyzed by Dr. Swerdloff.

UNDERSEA RESEARCH VESSEL COMMISSIONED FOR SMITHSONIAN

The Smithsonian Institution commissioned near Ft. Pierce, Fla., in January a 5-man submersible research vessel capable of exploring the ocean at depths of 1,000 feet or more.

The Johnson-Sea-Link, a small acrylic and aluminum diver-carrying vehicle, is named for designer and donors, Edward A. Link, and industrialist J. Seward Johnson. The vessel is capable of staying submerged up to 48 hours.



The Johnson-Sea-Link for exploring ocean depths.

Need for Ocean Study

Smithsonian Secretary S. Dillion Ripley noted at the commissioning that the Johnson-Sea-Link "holds vast potential for the environmental research scientist. . . .

"We now recognize that the integrity of the world's oceans is jeopardized by the same man-created pollution that has so dismally and dangerously affected other aspects of the human environment including many of our inland lakes and waterways. Now more than ever it is critical to study the oceans, so that we may become wiser stewards of a medium that covers two-thirds of the earth, is essential to all life, and holds so much promise in so many ways.

"Our hope is that this technically advanced, submersible link with man's origins will become an invaluable tool in studying the seas around us, adding to the body of human knowledge that serves the human family."

The Vessel

The Smithsonian believes the vessel promises to be one of the most effective small submersible vehicles being built to penetrate the shallow depths of the continental shelf.

It includes a 2-man transparent acrylic sphere, 6 feet in diameter and 4 inches thick. The sphere gives panoramic underwater visibility to a pilot and a scientist-observer. Behind sphere is a separate 3-man, 8-foot-long compartment that will enable 3 scientists to leave from its bottom and collect specimens of flora and fauna.

The 23-foot-long, 18,000-lb. vessel has 6 electric motors that propel it up to four knots. The pilot can scan in all directions through acrylic sphere. This makes it easier for him to hug the bottom and maneuver effectively.

Safety Emphasized

The engineering of the submersible emphasized safety. More than 100 innovations were incorporated. Switches, connectors, and all operating gear were specially designed.

Two divers will operate as a team outside the chamber and a third will remain inside chamber as a safety officer. When the divers are outside, they will be tethered for recovery. Electronic devices will monitor and transmit diver heartbeat and respiration rates to a surface support vessel. A trained physician will always be on duty during dives.

Program for Vessel

At first, the vessel will be used off Florida to study the kinds, populations, and distributions of organisms on the shallow sea floor. Also, it will be used to study freshwater upwelling from Atlantic's bottom. As research program progresses, the craft may be used to study sharks, porpoises, manatees, and the biology of coral reefs.

OCEANOGRAPHY

NOAA ISSUES FIRST MAPS OF FLORIDA'S SEAWARD BOUNDARIES

NOAA's National Ocean Survey has issued 5 maps in a 6-year program to establish Florida's seaward boundaries. Eventually, more than 400 maps will be published covering Florida's east and west seaward boundaries and the Florida Keys.

The first maps cover a 25-square-mile area at False Cape, immediately north of Cape Kennedy, and the Cape Kennedy and Indian River Inlet areas. Seven more maps of these areas will be issued within the next 6 months.

The program specifies mapping the mean low-water and the mean high-water lines along Florida's tidal waters.

What's At Stake

At stake in the mapping operation is ownership of coastal and offshore lands intermittently covered by the tide. The problem involves determination of U.S., state, and private boundaries.

In coastal areas, the mean high-water line generally marks the boundary between state and private property. In determining limits between U.S. and state ownership, the mean low-water line is the base line, or starting point. Florida claims ownership beginning at mean high-water line and extending offshore 3 miles beyond mean low-water line along Atlantic coast--and to state's historic boundary not over 3 marine leagues along gulf coast.

Where To Get Them

The maps are being published at a scale of 1:10,000 (one inch equals 833 feet). Copies may be purchased for $2.50 each from National Ocean Survey, Distribution Division (C-44), Washington, D.C. 20235.

MARINE SCIENCE CENTER IS DEDICATED IN MIAMI

The $2.1-million Henry L. Doherty Marine Science Center was dedicated on Feb. 26, 1971, at the Virginia Key Campus of the University of Miami's Rosenstiel School of Marine and Atmospheric Science.

"It will be the focal point of the ocean science and industry complex in South Florida, which now constitutes one of the world's major ocean-oriented communities," said Dr. F.G. Walton Smith, Dean of the School. MSC "will serve as a data center where laymen can benefit from the work of the high-caliber group of ocean scientists in the Virginia Key oceanographic complex. The new Center will also be focal point for group discussions among these ocean experts--a place where communication of ideas will strike sparks in the brains of scientists."

The Center

When furnished, the 3-story Center will house the School's library and contain geological-biological data files and collections for study by visiting scientists, students of oceanography, and others. The building will have a computer center, dining room, auditorium, and conference rooms. Residence suites for visiting investigators will be available. Also, there will be educational and service facilities to provide oceanographic information to the public. The building is scheduled to be ready in April 1971.

KILLER WHALES SEEN PURSUING STELLER SEA LIONS

On a recent Bering Sea patrol aboard the USCG Cutter 'Storis', Jim Branson of NMFS Alaska Office of Enforcement and Surveillance, saw a pod of 7 killer whales pursue a band of 20 to 25 Steller sea lions around a Soviet SRTM trawler for over an hour.

Branson reported 9 trawlers operating about 35 miles northwest of Unalaska Island. Each vessel was accompanied by a band of sea lions waiting to feed on fish lost from the trawl as it was hauled.

Whales Pursue Lions

As the Storis came alongside the trawler 'Iskra', a group of killer whales closed in on the sea lions. The latter appeared to panic and clustered alongside the trawler. As the whales moved in, the sea lions dived under the trawler, or swam around the bow or stern seeking safety on the other side. The whales followed but did not attack as long as the sea lions remained tightly grouped. After about 20 minutes, two whales leaped clear of the water and charged the sea lions. A small group of sea lions split from the main group, and one was taken. The whales approached again and again to within a few feet of the trawler and the cutter.

The Storis observed the SRTM's trawling operation for an hour and then departed. The killer whales were still harassing the sea lions, which had become very tired.

DECADES-OLD OCEAN DATA MAY BE A CLUE TO TODAY'S POLLUTION

Oceanographic data collected up to 20 years ago from U.S., Canal Zone, and Puerto Rican coastal waters as part of defense planning will help provide scientists today "with a base on which to determine whether or not significant pollution has invaded these waters," Rear Admiral W.W. Behrens Jr., Oceanographer of the Navy, has disclosed.

The data, which depict the ecology of waters in 13 major harbors and their seaward approaches, have been turned over to NOAA's National Oceanographic Data Center (NODC).

The Data

The data include analyses of the waters' plankton content, temperature, current flow, and salt, sediment and mineral content, and topography.

The East Coast harbor areas covered ranged from Penobscot Bay, Maine, through Mayport, Fla., to the Atlantic side of the Panama Canal. The Pacific areas spanned the West Coast from the Canal Zone to Puget Sound.

The data included similar collections from Navy-funded surveys by scientists of the National Ocean Survey (formerly U.S. Coast and Geodetic Survey), and by contract oceanographers.

FPC: THE NMFS EXPERIMENT & DEMONSTRATION PLANT PROCESS

Robert C. Ernst Jr.

The National Marine Fisheries Service (NMFS) has constructed an experiment and demonstration plant at Aberdeen, Washington,[1/] as part of a research and development program to demonstrate the feasibility of producing and using fish protein concentrate (FPC). The plant was constructed under Public Law 89-701[2/] for about $2 million.

This 'semi-works plant' (less than commercial size) was built to demonstrate an isopropyl-alcohol extraction process and to produce sufficient quantities of FPC for utilization studies by U.S. industry and the Agency for International Development.

The plant was designed, constructed, and is being operated under contract by Ocean Harvesters, Inc., a joint enterprise of SWECO, Inc., Los Angeles, Calif., and Star-Kist Foods, Inc., Terminal Island, Calif.

FISH PROTEIN CONCENTRATE

The basic concept of FPC derives technically and logically from a need to utilize our fishery resources more economically and efficiently as a source of animal protein for human nutrition. FPC is the term used for a broad class of nutritious fish products that can be used in human foods.[3/] These concentrates are primarily animal protein and are characterized by high nutritional quality and stability under a wide range of storage conditions. Variations in processing methods may result in products with many different organoleptic (determined by subjective testing: odor, flavor) and physical characteristics. The concentrates, for example, may be liquids, pastes, or powders. Also, they may be completely odorless and tasteless--or be highly flavorful with cheese or meatlike flavors.

MANY FPC PROCESSES POSSIBLE

Many processing methods[4/] may be used to produce FPCs: some are chemical or biological hydrolysis; protein isolation by extraction and precipitation; vacuum drying and extraction; cooking, pressing, drying, and extraction; and dehydration and extraction with solvents. Whatever method is used, the object is to obtain a concentrated, stabilized form of high-quality animal protein either by isolation of the protein or adequate removal of water, lipids, and any other components considered undesirable in the final product.

DEMONSTRATION PLANT & PROCESS

The process used in the demonstration plant design is a multistage, continuous flow, countercurrent extraction of fresh, ground, whole fish with 91% by volume isopropyl alcohol. The design is based on research and development by NMFS[3/] and by subcontractors[5,6/]. Since the plant will be operated for a very limited period, about two years, many compromises were made to lower capital costs at expense of operating costs. The plant is designed to process up to 50 tons of whole fish per day into $7\frac{1}{2}$ tons of FPC that will meet the standards approved by the U.S. Food and Drug Administration[7/].

Mr. Ernst is Research Chemical Engineer, National Center for Fish Protein Concentrate, National Marine Fisheries Service, College Park, Maryland 20740.

COMMERCIAL FISHERIES REVIEW
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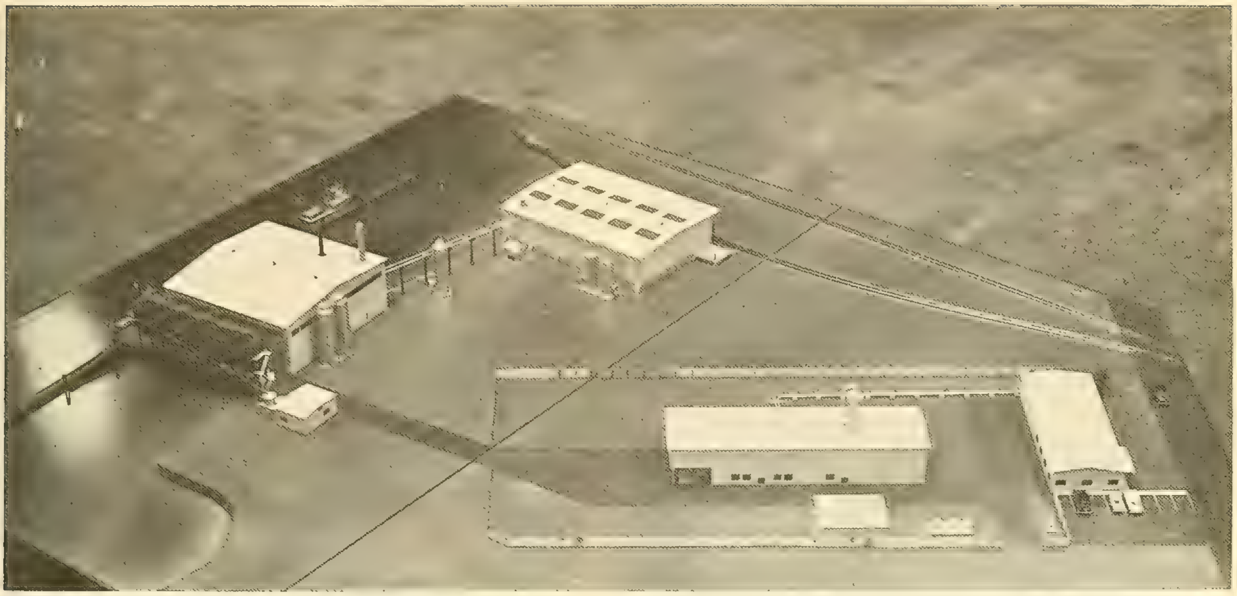

Fig. 1 - Model of Experiment & Demonstration Plant shown in relation to Port of Grays Harbor dock (Washington State) and former Pacific Protein facilities.

In the process, fresh fish are ground and extracted with azeotropic isopropyl alcohol to remove water and lipids. Extraction is performed in a 4-stage countercurrent series of mixing tanks and separating operations, using screens and presses. The extracted solids are desolventized, milled, and bagged, producing FPC. Oil is separated from the extract, and solvent is recovered by distillation for re-use. The following is a step-by-step description of the processing operation.

Unloading

Fresh fish received by boat at the plant are first inspected to see that they meet food quality standards. Then the fish are unloaded by a vacuum, fish-unloading system, which was part of the former Pacific Protein Plant. The system has a capacity of 75 tons of fish per hour. The fish are drained, washed, and conveyed from the fish pump to a calibrated volumetric fish meter. Then the fish are conveyed to the chilled brine-storage system.

Brine Storage of Fish

One hundred and fifty tons of fresh fish can be stored at 32° F in the chilled brine-storage system. This will sustain continuous plant operation up to 3 days. The storage tank is

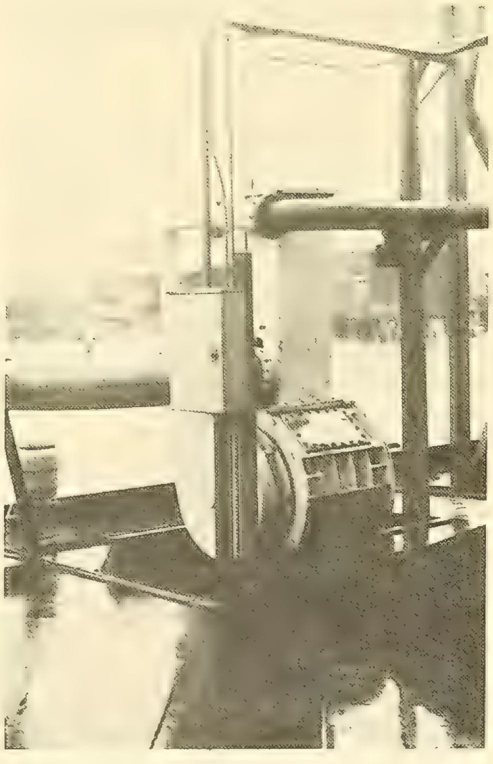

Fig. 2 - Fish are unloaded from holds of boats by fish pump operating on vacuum principle.

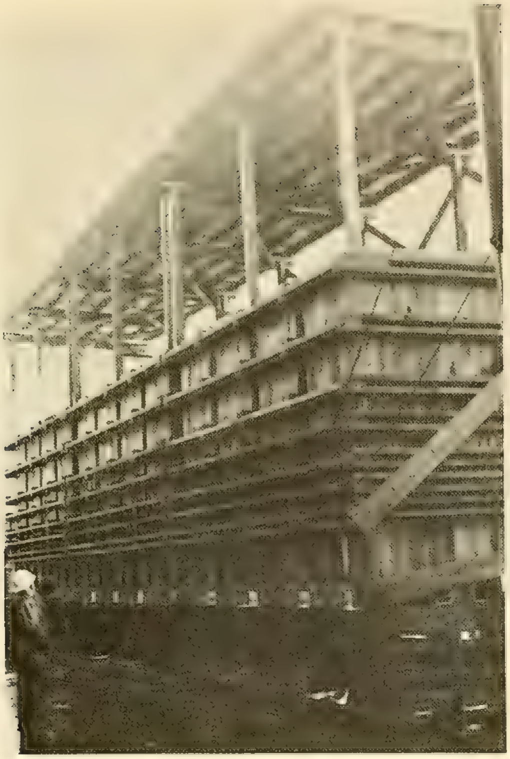

Fig. 3 - Fish can be stored for several days in these redwood tanks.

constructed of redwood. It contains 12 separate, 750-cubic foot, galvanized, steel-lined compartments, each with a capacity of 12.5 tons of fish. The refrigeration capacity is approximately 100 tons. The storage tanks are partly filled with prechilled brine before being charged with fish to obtain more rapid chilling and to reduce physical damage to the fish. Fish are loaded into the storage tanks by deflection from a belt conveyor. The brine is circulated continually from a settling tank through the chiller and up through the fish. Brine quality is checked pariodically by NMFS Support Laboratory to maintain a low-solids content and low-bacterial count. An automatic brine make-up system supplies brine from fresh potable water and salt. No bactericides or inhibitors are used in the brine. When plant demands fish, a compartment of fish is drained of brine, and the fish discharged by gravity into 260-gallon, galvanized steel, drop-bottom, tote bins each holding about 2,000 pounds of fish. The bins of fish are transported by fork-lift truck to processing building, where the exact net weight of fish is determined on a platform scale. Then the fish are unloaded onto a conveyor-elevator and are washed with fresh water to remove any adherent brine.

Comminution and Slurrying

Fish from the conveyor-elevator--a 24-inch-wide, inclined, cleated rubber, belt conveyor--are fed to the hopper of a screw feeder 18 inches in diameter by 6 feet long. Comminution (reduction to minute particles) is accomplished in a 40-h.p. Reitz inclined disintegrator using an 18-inch screen with $\frac{1}{4}$-inch openings. The screw feeder is controlled by a current meter on the disintegrator. A reversible screw conveyor from the disintegrator discharges to either of two 1,000-gallon slurry mix tanks, where the ground fish is mixed with a controlled amount of miscella (M-2) from the second stage of extraction. The mix tanks are equipped with 10 h.p., 125-rpm turbine-type agitators, and each contains 4 removable baffles. Associated with each tank is a 10-h.p. centrifugal pump for transfer or recirculation of the slurry.

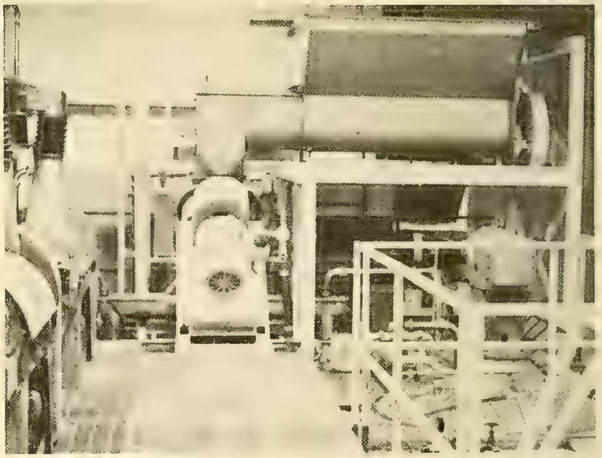

Fig. 4 - Several tons of fish per hour can be ground in this large comminutor.

The fish can be deboned, if desired, by processing through a Zebarth Beehive deboning machine. In this case, fish are fed to the deboner from the disintegator and then pumped to the slurry mix tanks.

Batching of the feed slurry (comminuted fish and miscella M-2) permits periodic shutdown of the disintegrator for cleaning, replacing screen, or other servicing without

interrupting continuous flow of extraction system. Over an hour of down time can be available at design capacity (50 tons of fish per day).

Extraction

Batches of fish and M-2 slurries are prepared and pumped intermittently to the 1,500-gallon feed tank or first-stage mixing tank. Flow of slurry from the tank is maintained constant and marks beginning of continuous extraction system. The first-stage mixing tank contains a level indicator and alarm, but the level must be maintained manually. Suspension of the slurry is maintained by a turbine-type agitator driven by a 10-h.p. motor. The mixing vessel is jacketed, and the temperature of the slurry can be automatically controlled up to 180° F. Present operating conditions, however, specify no heat addition beyond that introduced by the warm miscella (M-2) for this first stage of extraction. Normal operating temperature should be approximately 120° F. The slurry is pumped from the first-stage mixing tank to a SWECO Separator (60-inch diameter, 200-mesh vibrating screen) for primary separation of solids from miscella. Discharge rates from the tank are maintained by manual control of a 2-h.p. variable-speed rotary pump and establish the feed rate to the extraction system. The design rate is about 30 gallons per minute.

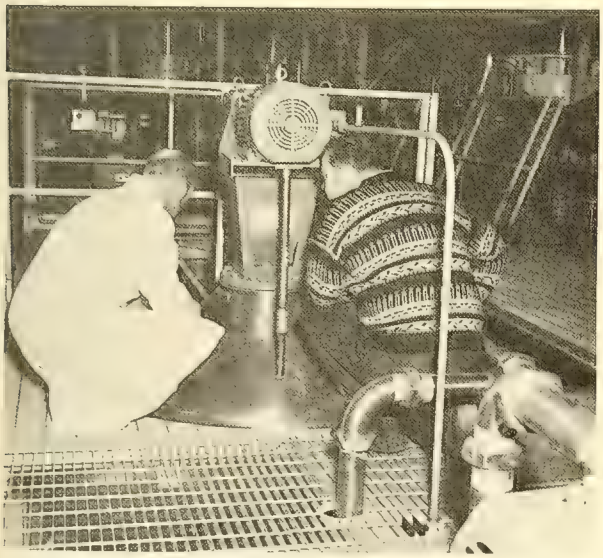

Fig. 5 - The comminuted (pulverized) fish is mixed with isopropyl alcohol in large slurry tanks.

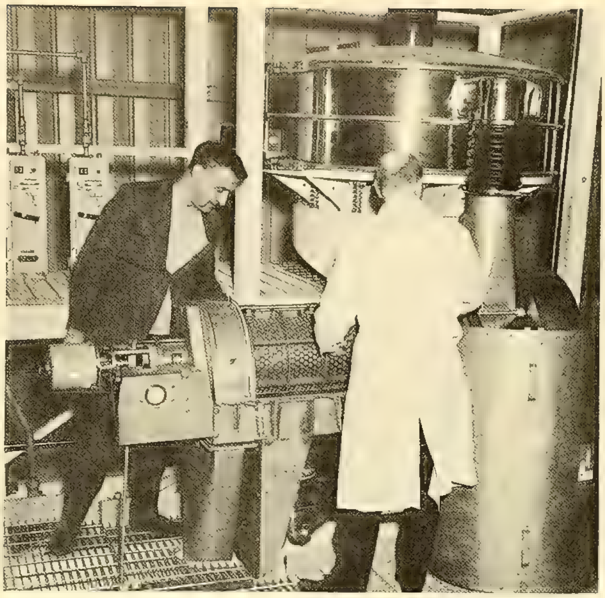

Fig. 6 - The protein portion of fish slurry is separated from this miscella in a series of shaker screens and pulp presses. The top of pulp press has been removed for inspection.

The solids from the screen discharge to a Brown International Pulp Press, which reduces further the liquid content of the solids. Solids from the press discharge by gravity to the next extraction vessel. Volatile content of the solids from this first-stage press are approximately 60%. Lipids content of the solids, when using a 2:1 overall alcohol to fish ratio, are about 4% on a dry basis. The liquid effluents from the press and screen are combined and referred to as first-stage miscella (M-1). This miscella is pumped to a 300-gallon vessel and processed further to recover solvents and by-products. The feed tank, pump, screen, and press constitute the first stage of extraction.

Solids from the first stage of extraction are mixed with miscella (M-3) from the third stage of extraction in the second-stage, 800-gallon, agitated, jacketed vessel. Temperature is maintained automatically at 165° F. Slurry flow from this vessel is controlled manually, but it is constant once the system is operating under steady-state conditions. The tank level is indicated and changes must be compensated by manual control of the discharge pump. The level in any of the extractors and the discharge flow rate establish an average residence time or extraction time. The extraction time can be altered by changing the operating level. A 600-gallon level

results in an extraction time of about 20 minutes for that stage.

At present, 4 stages of extraction are used in the system. The equipment used in the 4 stages are similar. A 1,500-gallon extraction vessel and a 60-inch-diameter vibrating screen are used in the first stage; 800-gallon extraction vessels and 48-inch screens are used in the 3 later stages. An extraction vessel, a slurry pump, a screen, and a press constitute the basic equipment for an extraction stage.

Fresh solvent (new or reclaimed) is introduced to the fourth or last stage of extraction through a heat exchanger. Temperature and flow rates are automatically controlled to preset conditions. The solvent rate is commensurate with the solvent ratio desired and the fish feed rate to the first stage.

Desolventizing

Desolventization of the solvent wet solids is accomplished by introducing steam countercurrently to the solids in a Strong-Scott Solidaire Processor Model SJS 24-16, followed by final redrying and conditioning of the solids in additional units. Four units 16 feet long and 24 inches in diameter are used in series. Final moisture is controlled below 9% and residual alcohol below 250 parts per million. Uncondensed steam and volatilized solvent are condensed and sent to solvent recovery. The desolventized solids are conveyed to the milling room in a 6-inch screw converyor.

Milling and Bagging

The dry solids from desolventizing are received in the hopper of a variable-speed screw feeder to the mill. The mill is a Pulverizing Machinery Company Model 60 ACM mill driven by a 75-h.p. motor. The solids are milled to pass 200 mesh, then received in a Micro-Pulsaire bag collector; they are bagged in 50-pound, polyethylene-lined, multiwall paper bags. After check-weighing and sealing, the bags are palletized

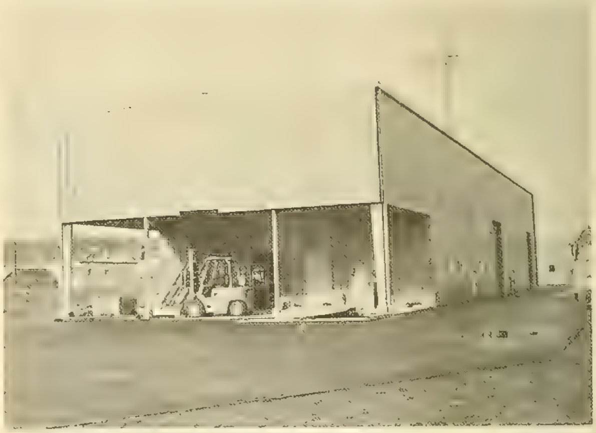

Fig. 8 - The solvent is recovered by distillation in 54-foot tower that extends above roof line of plant.

Fig. 7 - The wet solids are desolventized in a series of 4 large steam-heated drying units. The equipment is arranged compactly in a steel framework designed to facilitate transport from its fabrication point in Los Angeles, Calif.

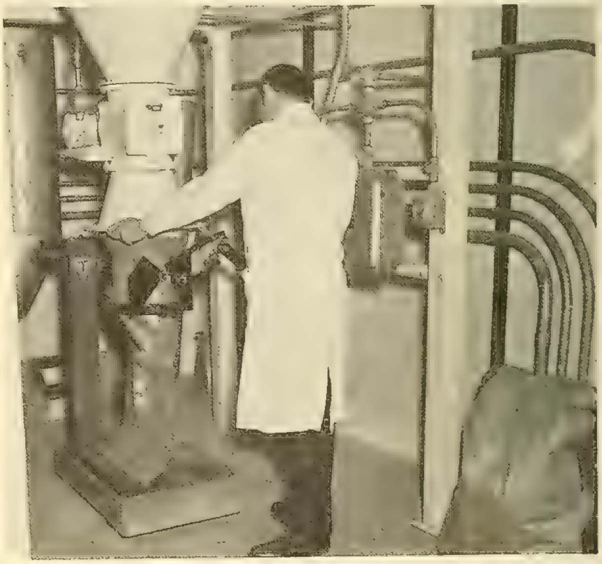

Fig. 9 - Pulverized FPC is milled and bagged in a separate room.

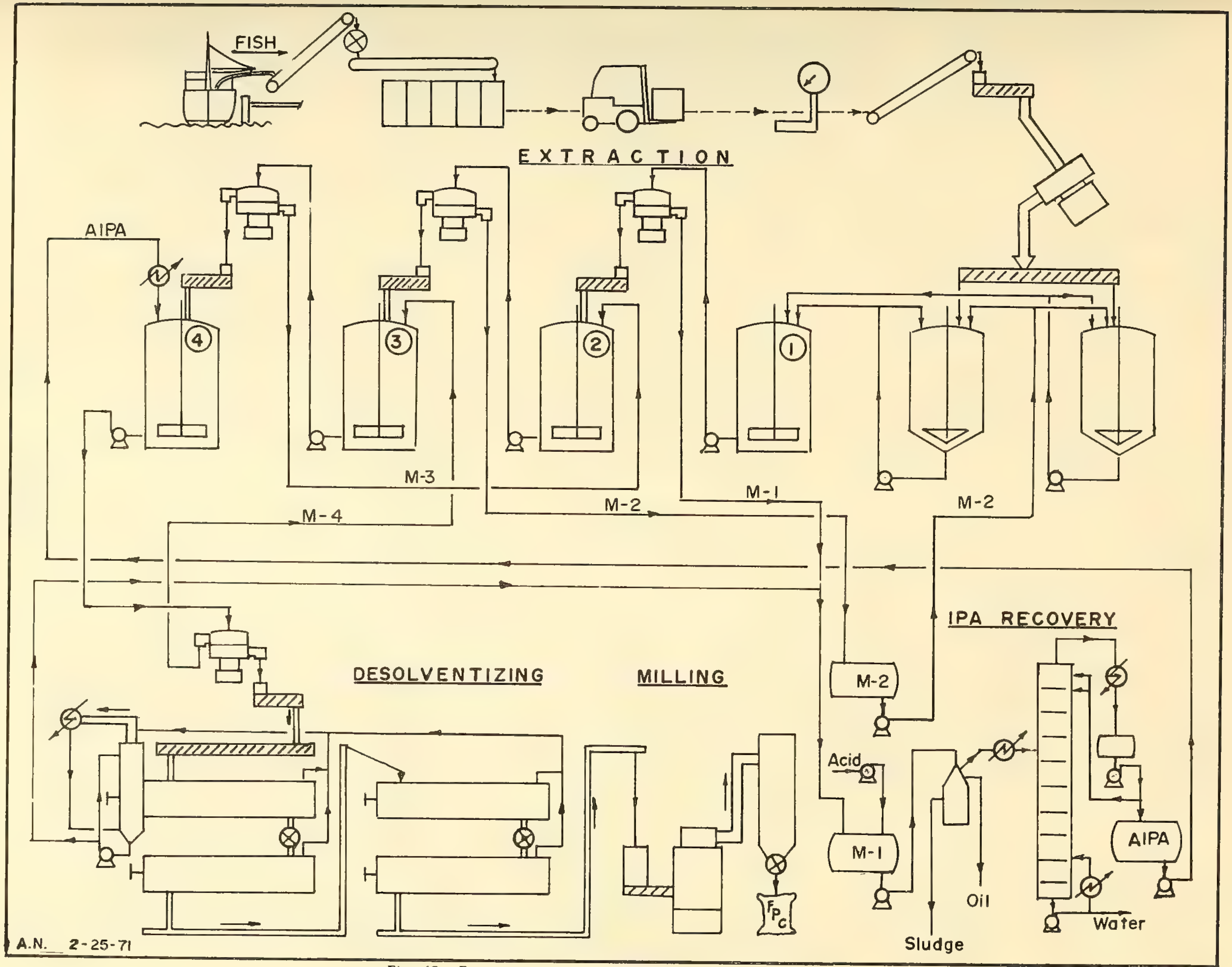

Fig. 10 - Experiment and demonstration plant flow diagram.

and stored for shipment. The milling and bagging are performed in a room separate from other process areas to maintain a high degree of sanitation. All air is filtered and sanitary.

Solvent Recovery

Miscella (M-1) discharged from the first-stage screen and press flows by gravity to a 250-gallon vessel. Phosphoric acid is added to the incoming miscella stream by a metering pump to adjust the pH to 4.5. The acidified miscella is then pumped to a Westphalia Model SOAH-5036-SLS centrifuge for clarification prior to distillation. A concentrated oily protein sludge is thus separated from the miscella by the centrifuge and is discarded soon after as a waste product.

The acidified and clarified miscella is pumped through a preheater into a 4-foot-diameter, 54-foot-high distillation column containing 24 Koch, Type T trays. Heat is supplied to the column by a forced-circulation reboiler. In the column, the alcohol is stripped from the miscella and concentrated to the water azeotropic composition of 91% alcohol by volume (87.7 weight %). The reclaimed alcohol is sent to solvent storage for re-use in extraction. The bottoms product is a mixture of water, oil and fish solubles.

The bottoms product from the still is, essentially, an acidified fish water which, in a commercial plant, would be further processed to produce fish oil and condensed fish solubles. At present, no facilities have been incorporated in this plant to provide for by-product recovery. Present still bottoms are disposed of as waste.

SANITATION

Plant and process sanitary controls are strictly maintained. The equipment can be cleaned by a pressurized detergent method called a clean-in-place system. All plant equipment is constructed to food-grade standards.

The raw material and final product are inspected by a government inspector. Chemical and microbiological examinations of the plant's equipment, its environs, and the product are conducted continuously.

SUMMARY

This experiment and demonstration plant should demonstrate adequately a commercially feasible process to produce a highly nutritious fish protein concentrate. The plant will produce a supply of commercially reproducible product for utilization studies and evaluation. This is a first-generation process and plant design that should provide valuable information for further commercial designs. Modifications of the plant, together with flexibility of basic equipment, will permit reasonable latitude for process changes and the processing of various fish species.

During plant operation, special efforts will be made to acquire data on material balances, operating factors, and related product quality needed to evaluate the process and the product. An on-site chemical and microbiological laboratory capability has been established to provide the operators with information needed for process and product control.

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CURRENT SKIPJACK OCEANOGRAPHY CRUISES IN EASTERN TROPICAL PACIFIC OCEAN

F. Williams

A series of skipjack oceanography cruises is planned for two offshore areas in the eastern tropical Pacific Ocean. This report reviews the objectives, operational procedures, and preliminary results of the first of these cruises--by the NMFS research vessels 'David Starr Jordan' and 'Townsend Cromwell', about 1,100 to 2,500 nautical miles south of San Diego, Calif., in October-December, 1970.

The regulation of yellowfin tuna in the eastern Pacific Ocean, through an annual catch quota, has necessitated the utilization of alternative tuna resources by the U.S. tuna fleet for much of the year. One of the most important alternatives, and in the same general region, is the stock of skipjack tuna (Katsuwonus pelamis), which is unregulated and currently underexploited. At present, skipjack are only fished heavily in the inshore areas along the American coasts, but they certainly occur offshore. Indeed, U.S. purse seiners fishing north of the Equator to the west of the boundary of the IATTC* regulatory area took about 900 tons of skipjack in 1969 and 6,300 tons in 1970. However, these vessels were fishing primarily for yellowfin, and skipjack catches were largely incidental. Offshore skipjack are expected to contain a considerable proportion larger in size than those taken in the inshore fishery and hence more acceptable to the canning industry.

THE EASTROPAC expedition of 1967-68, for which the National Marine Fisheries Service (NMFS) was the lead agency, gave oceanographic results (Love, 1970 and in prep.). These indicated environmental conditions generally suitable for skipjack: surface temperature at 20°-29° C and presence of skipjack forage (food) over a large region north of 5° S from 100° to 130° W. More detailed work on EASTROPAC data (Blackburn and Laurs, in press) has shown that the skipjack forage was concentrated in several zonal (east-west) bands, and at levels of abundance equal to, or greater than, those in existing inshore skipjack fishing areas. Skipjack do occur in these offshore forage-rich zones. This was shown in October 1969, when the Honolulu-based NMFS research vessel 'Charles H. Gilbert' fished north of the Equator near 120° W, where there is normally a forage-rich zone. Many skipjack were seen and caught (Hida, 1970).

The current series of skipjack cruises is designed for detailed investigations, on a seasonal basis, of the occurrence and relative abundance of skipjack in two areas (designated 'A' and 'B' in Fig. 1) of offshore waters considered most suitable for skipjack. To understand their occurrence in such offshore areas, we need to know the ways in which ocean features and conditions determine the distribution and migrations of skipjack.

This report reviews the objectives, operational procedures, and preliminary results of the first cruise. It was a 2-vessel operation, in October-December 1970, in the eastern tropical Pacific about 1,100 to 2,300 nautical miles south of San Diego (Area 'A' Fig. 1): The NMFS research vessel Townsend Cromwell (Hawaii Area Fishery Research Center, R. Uchida, NMFS-Cruise Leader), left San Diego October 23 and arrived in Honolulu November 29; and the David Starr Jordan (Fishery-Oceanography Center, La Jolla,

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*IATTC--Inter-American Tropical Tuna Commission.

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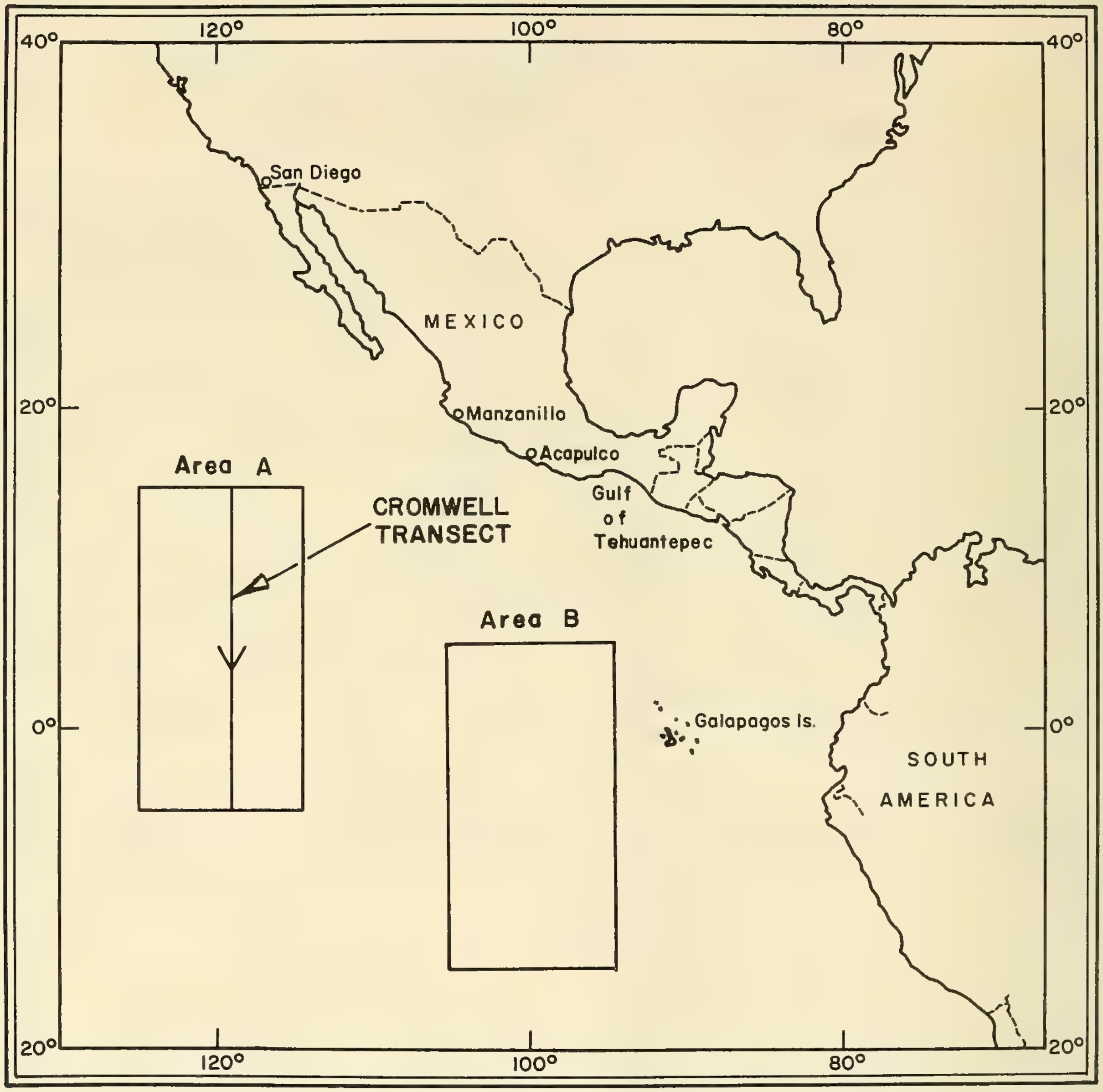

Fig. 1 - Areas of eastern tropical Pacific Ocean under investigation in current series of skipjack oceanography cruises. Also shown is location of oceanographic transect of Area 'A' completed by Cromwell in Part I - Operations of first cruise.

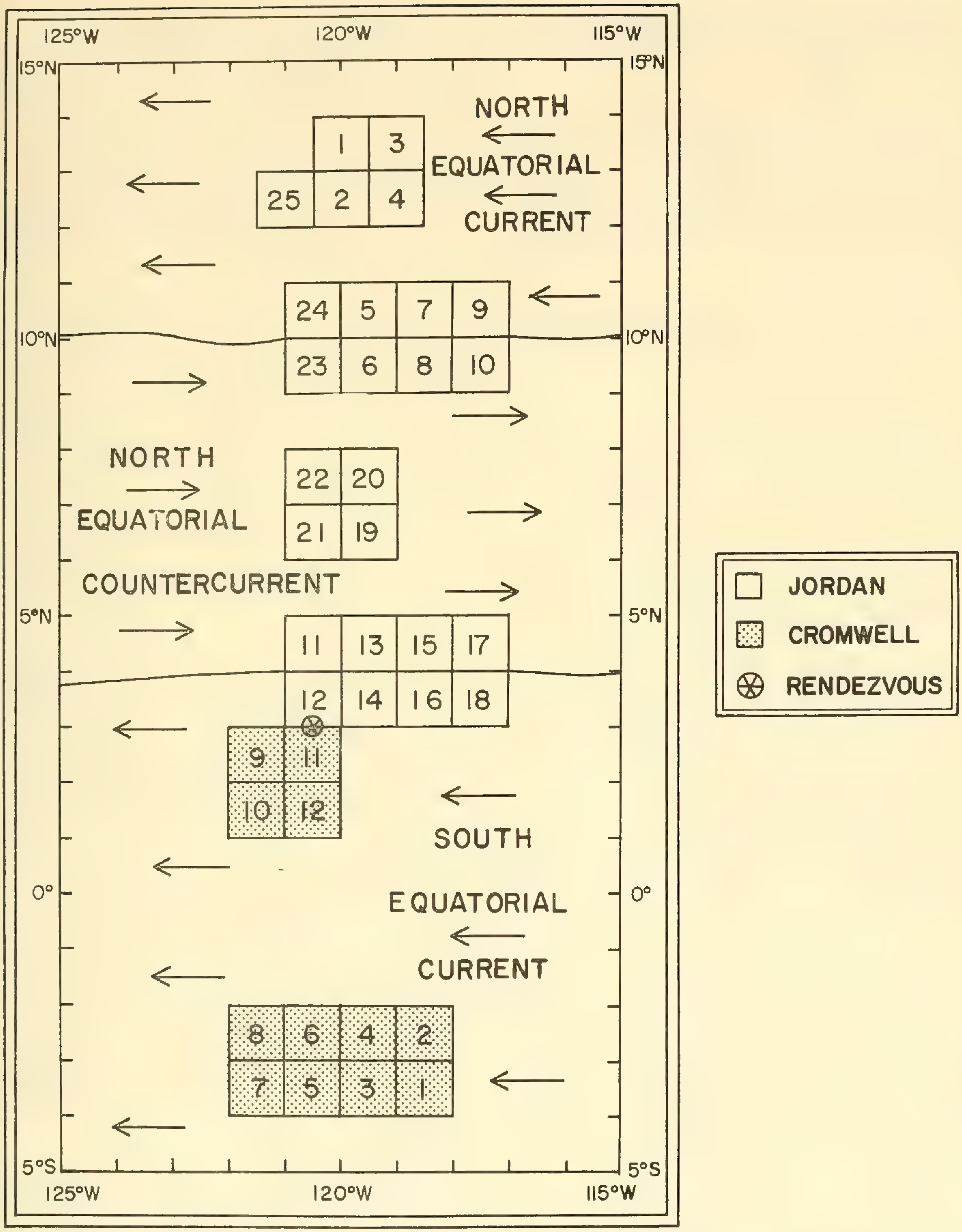

Fig. 2 - Unit areas investigated by Jordan and Cromwell in Part II Operations (first cruise) and relation to surface current systems. Numbers in quadrants of unit areas denote order of occupation by vessels.

F. Williams, STOR-Cruise Leader), which included NMFS scientists from Honolulu and La Jolla, and members of STOR Program and IATTC at La Jolla.

Within area 'A', investigation by the vessels was from 15° N to 5° S, 117° to 122° W. Operations were in two parts: in Part I, Cromwell made a rapid oceanographic transect of the area (Fig. 1); in Part II, both vessels made detailed fisheries and biological investigations of specific zones in the general area (Fig. 2).

OBJECTIVES, PROCEDURES & METHODS

Part I: Cromwell

In Part I operations, Cromwell's objective was to measure the distributions of a limited number of environmental and other factors--temperature, salinity, and oxygen (to 500 m.); surface chlorophyll, micronekton, meteorological--from 15° N to 5° S along the meridian of 119° W. This was accomplished in seven days with a series of oceanographic stations, including STD (salinity-temperature-depth data acquisition system) and/or Nansen casts, and micronekton hauls (oblique, to 200 m.) with the Blackburn 5' x 5' net, four times a day (0200, 0800, 1400, 2000 hr. PST). Between each station, about 45 to 50 miles apart, an XBT was launched to give additional data on the vertical temperature profile. Surface temperature and salinity were monitored continuously with the thermosalinograph, and surface chlorophyll at 3-hour intervals. All salinity, oxygen, and chlorophyll samples were processed on the vessel. Records were also maintained of fish schools, bird flocks, and marine mammals sighted.

The following data derived from Cromwell stations and records were transmitted daily by radio to the Jordan: 1) inflection points from temperature and salinity traces of STD and XBT analog charts, 2) raw surface chlorophyll measurements, 3) settled volume of micronekton per quart jar, and 4) summaries of weather, bird flocks, and fish schools sighted.

Part II: Cromwell and Jordan

In Part II, the first task was to compare results from Part I with historical data for the area, particularly that of EASTROPAC, and to delineate the zones in which oceanographic features and events were likely to be indicative of skipjack occurrence. This was carried out aboard the Jordan on receipt of data from Cromwell.

Then, the two vessels were to undertake detailed investigations in these zones to a standardized plan:

(a) to determine distribution and relative abundance of larval, juvenile, and adult skipjack;

(b) to measure distributions of a limited number of environmental factors (as in Part I) coincident with (a) above;

(c) to increase our knowledge of the skipjack ecosystem by sampling zooplankton and micronekton (for potential skipjack forage) and by relating these findings to the environmental conditions and fish distribution;

(d) to extend our knowledge of the skipjack's life history by study of gonads, stomachs, livers, and other vital statistics; and tagging of fish whenever possible;

(e) to use knowledge gained in (a)-(d) above to test a proposed model of the migrations of recruit skipjack into the eastern Pacific Ocean (see page 34);

(f) to develop a sonar-mapping technique for measuring the size and estimating the biomass of schools and aggregations of tropical tunas and their principal food organisms (Jordan only).

The standardized plan called for investigation of zones with a "unit area" approach, in this case a 2° x 2° area. The scheduled work for each 2° x 2° unit area took 96 hours, including run in and out; the observations were as in Fig. 3, and totals as given in Table 1.

Other observations--meteorological, continuous surface temperature, and salinity; surface chlorophyll (Jordan only); sightings of fish, birds, and mammals--were continued as in Part I.

The sonar-mapping design (Jordan only) was based on a similar study (Smith, in press) conducted for coastal pelagic species of the California Current Region. In particular, this entails determining the range and school size dependence on numbers of sonar targets per unit area.

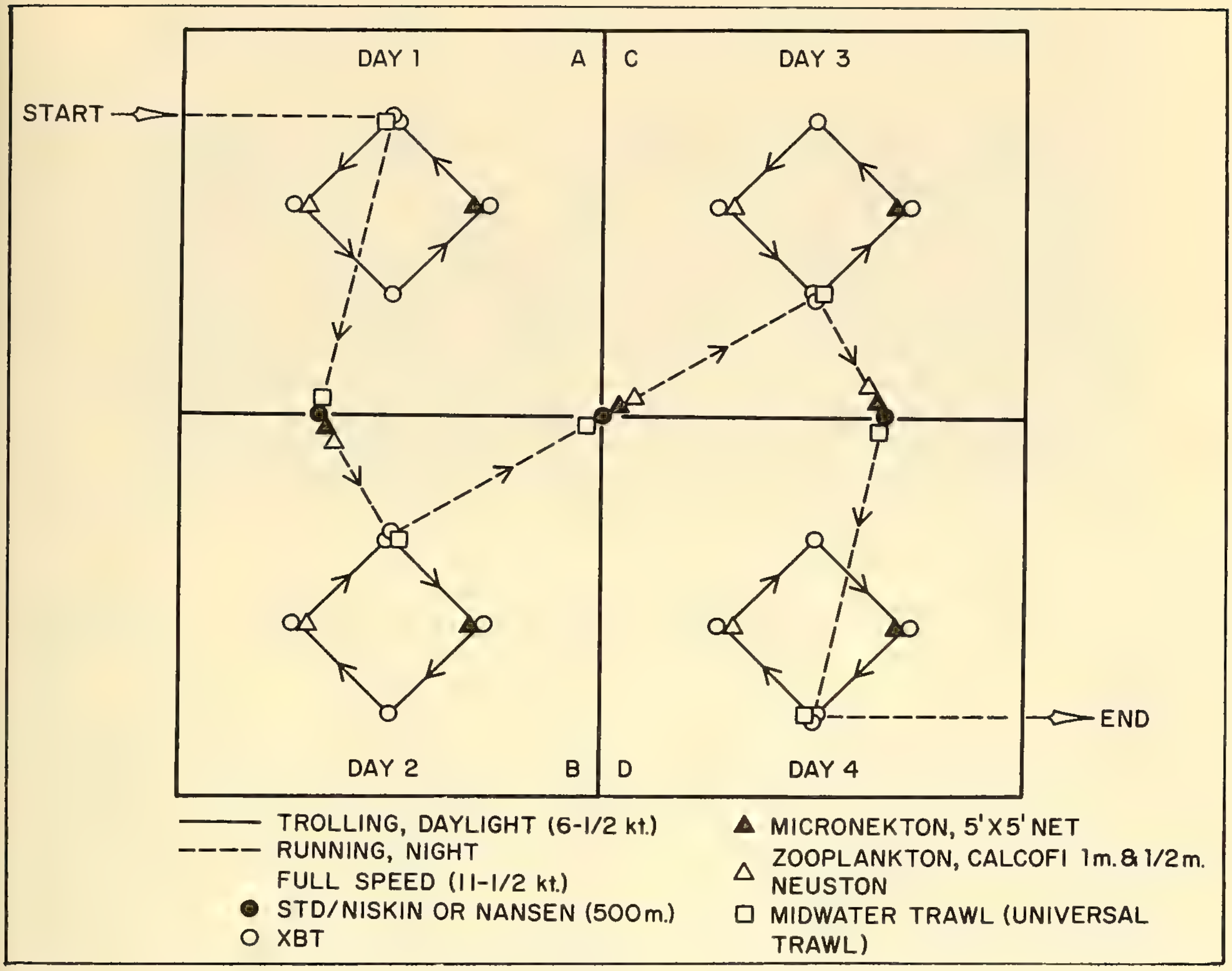

Fig. 3 - Track and scheduled observations for 2° x 2° unit area investigations.

Table 1 - Number of observations scheduled for each unit area (2° x 2° area)

Parameter	Gear	Day	Night
Adult skipjack	Trolling	40 hours	-
Juvenile skipjack	Midwater trawl	-	7[a]
Larval/juvenile skipjack	Neuston net	4	3
Larval/juvenile skipjack	1 m. CalCOFI net[b]	4	3
Micronekton	5' x 5' net	4	3
Zooplankton	1 m. & $\frac{1}{2}$ m. CalCOFI nets	4	3
Temperature, salinity, oxygen[c]	STD/Niskin or Nansen	-	3
Temperature	XBT	20	-

[a] 4 hauls occupied equal time either side of marine dawn.
[b] Same hauls as for zooplankton.
[c] No salinity or oxygen samples were obtained during Part II on Cromwell due to elimination of Nansen casts.

Fig. 4 - RV. Townsend Cromwell seen from RV. David Starr Jordan at high-seas rendezvous on Nov. 19, 1970, about 1800 miles south of San Diego. (On Jordan, note portside trolling outrigger, white pole, and door for midwater trawl.)

The unit areas investigated by the two vessels are shown in Fig. 2. The sequence in which the individual quadrants were occupied is indicated.

Jordan and Cromwell rendezvoused at 0900 November 19 at 3° N, 120°30' W. (Fig. 4), but a heavy swell prevented the envisaged transfer of data and some samples and equipment from Cromwell to Jordan. (The Cromwell departed for Honolulu November 20.)

SKIPJACK MIGRATION MODEL

The adolescent (sexually immature) fish, which form the bulk of the skipjack catch in the eastern Pacific, are considered to have a central Pacific origin (Rothschild, 1965). Any model of the migration of the juvenile skipjack (<35 cm) eastwards must account for the separation into the northern stock (Acapulco to California) and the southern stock (eastern Gulf of Tehuantepec to northern Chile).

The proposed migration model of Williams (in preparation) indicates that changes in flow of surface North Equatorial Countercurrent (NECC), due to seasonal changes in position of Inter-tropical Convergence Zone (ITCZ)--the meteorological equator--are responsible for north-south split of incoming recruit skipjack. When NECC eastward flow is continuous to Central America coast from May/June to December/January, skipjack are being recruited to the southern stock. Then, from about February to April, when the NECC is absent east of 120° W, skipjack are being recruited to the northern stock.

Thus a gating mechanism is considered as operating on incoming recruit skipjack at about 120° W, which is controlled by a major meteorological feature--the ITCZ-through the current system. Confirmation of this may lead to prediction of the percentage north-south split of annual skipjack recruits to the fishery based on the ITCZ position during the first four months of the year. Such information would be of strategic value to the tuna industry and to those studying skipjack population dynamics.

Testing this migration model is necessary if the oceanographic monitoring and forecasting system (presently for U.S. west coast albacore fishery) of NMFS Fishery-Oceanography Center, La Jolla, now being extended to tropical tunas, is to have predictive value for skipjack.

PRELIMINARY RESULTS

Part I: Oceanographic Transect

Preliminary analyses show the distribution of temperature (Fig. 5) and salinity was generally similar to that observed at the same meridian, 119° W, in late October, 1967, during EASTROPAC. The lowest surface

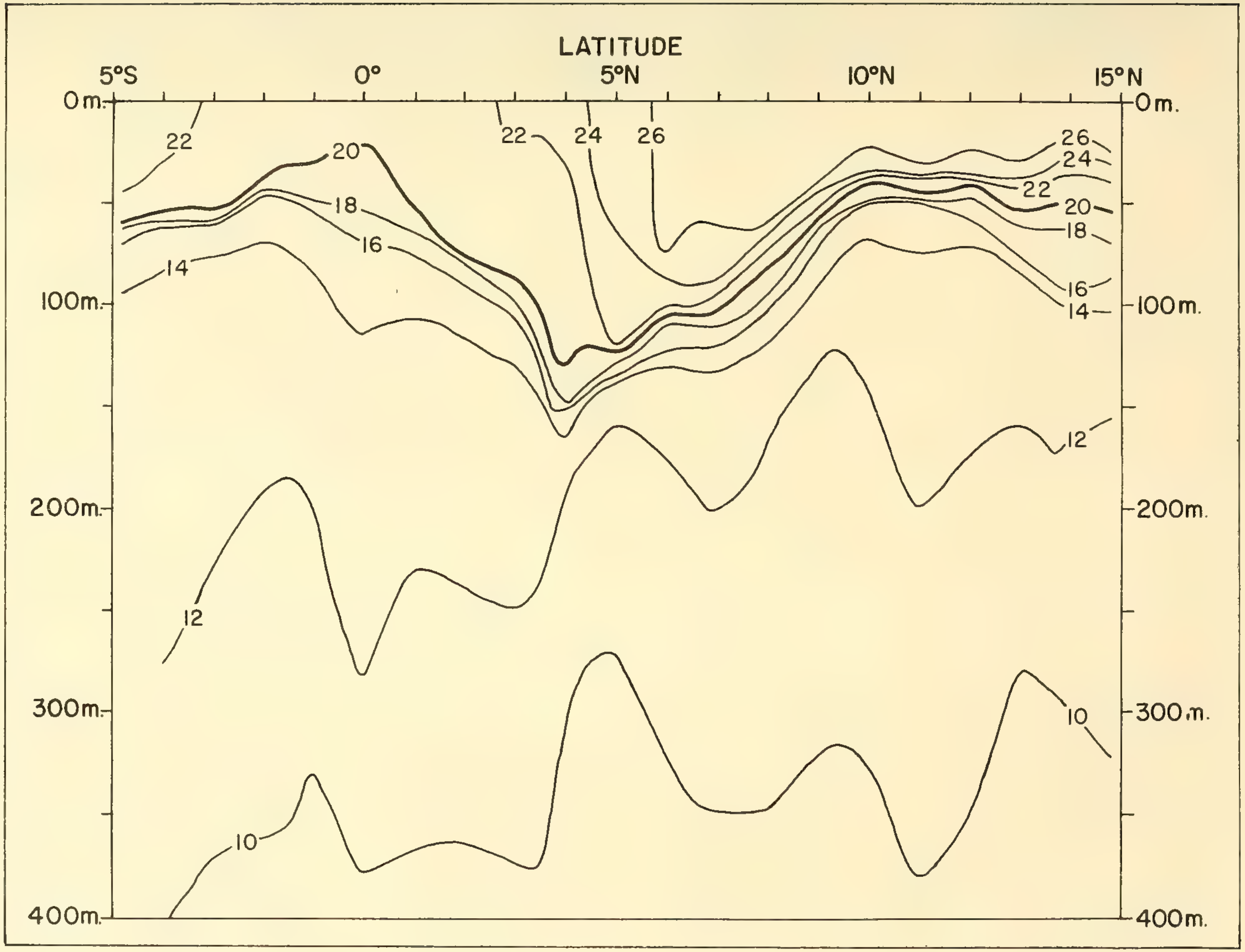

Fig. 5 - Temperature (^{o}C) section from 15^{o} N to 5^{o} S along 119^{o} W, Nov. 1-7, 1970 (Cromwell, Part I Operations--first cruise).

temperature, 20° C, was observed in the South Equatorial Current at 1° S, and the lowest surface salinity, 32.9 ‰, in the North Equatorial Current at 13° N. The slope of the thermocline indicated that the North Equatorial Countercurrent was well developed: the northern boundary was at 10° N, the southern at 4° N. No clear indication of the Equatorial Undercurrent was found in the temperature distribution. However, an isolated high-salinity core (maximum salinity about 35.2 ‰, centered at a depth of 50 m. at 1° S, suggested the Undercurrent).

Part II: Fisheries & Biological Observations

Zones Investigated

From the physical and biological data obtained during the transect (Part I) and comparison with historical data, the most likely zones for occurrences of skipjack were:

1) 12°-14° N, a zone of high micronekton catches and shallow mixed layer in the North Equatorial Current (NEC), but not far from the surface North Equatorial Countercurrent (NECC);

2) 9°-11° N, straddling the NEC-NECC boundary;

3) 3°-5° N and 1°-3° N in the high "productivity" band of the South Equatorial Current (SEC), between the NECC southern boundary and cold upwelled equatorial water (at approximately 0°30' N);

4) 2°-4° S, a zone of relatively high productivity in the SEC south of the equatorial upwelling.

It was decided also to examine a zone at 6°-8° N near the center of the NECC, where skipjack might be expected to be absent or present only in small numbers. The equatorial zone from about 0°30' N to 2° S was not examined because near-surface temperatures were considered rather low for skipjack occurrence.

Relative Abundance of Tuna

Trolling time averaged about 10 hours per day at 6½ knots; the effort in each zone was 4-8 days. Skipjack and yellowfin tuna were the principal species caught (boarded, tagged, or lost but identified). Relative abundance of tuna in 2° latitude zones--expressed as mean-number of fish caught per line-hour x 10^3, all longitudes combined--is given in Table 2.

Table 2 - Relative abundance of troll caught tuna

Current System	Zone Latitude	Mean catch per line-hour x 10^3	
		Skipjack	Yellowfin
NEC	12°-14° N	52	34
NEC/NECC	9°-11° N	39	11
NECC	6°- 8° N	43	2
NECC/SEC	3°- 5° N	115	8
SEC	1°- 3° N	196	0
SEC	2°- 4° S	82	0

Relative abundance data in Table 2 are based on catches along the fixed tracks shown for each quadrant of 2° x 2° unit areas (see Fig. 2). They do not include the larger catches made when the vessel circled and chummed, with anchovy live bait, schools from which fish already had been taken trolling.

Skipjack were most abundant in South Equatorial Current from 1°-3° N, and yellowfin in North Equatorial Current from 12°-14° N. Yellowfin tuna, always less abundant than skipjack, were not caught south of 3° N, and most were small--less than 35 cm. The skipjack caught were mainly smaller or larger than average size of those taken in inshore commercial fishery off U.S.: they were less than 40 cm., or greater than 55 cm. (up to 71 cm. and 20 lb.). The small skipjack were mainly in North Equatorial Current from 12°-14° N, but some also were in the NEC from 10°-11° N and the SEC from 3°-4° N; the large ones predominated in the other zones. Relative abundance of skipjack in center of the NECC (6°-8° N zone) appeared similar to that in zones to the north.

First results show that for 2° or 1° latitudinal zones there is a significant positive correlation (probability at 5% level) between surface chlorophyll levels and skipjack relative abundance.

Tagging

Sixty-seven skipjack and four yellowfin were tagged from the two vessels during the cruise.

Fish Schools, Bird Flocks, Marine Mammals

Very few tuna or other fish schools were seen at the surface in survey area, and these were restricted to 7°-11° N. Birds (flocked or unflocked) were most common, but never abundant, in this region; porpoises were seldom seen. However, on passage to Honolulu, and just outside survey area (6°-8°40' N, 128°30'-133° W), the Cromwell encountered on two successive days many flocks of birds over fish schools. Few of the latter were identified, but one or two on each day were noted as 4-8 lb. skipjack.

Live Bait

Fifty scoops of anchovy live bait were taken aboard Jordan in San Diego and used as chum on tuna schools. And, on at least 3 occasions, this resulted in keeping a school of skipjack near the vessel's stern and increasing considerably the troll catches. Fish had taken the live bait as shown by fresh anchovies in the stomach contents. The anchovy were taken on board in 17° C water and withstood water temperatures exceeding 29° C during the cruise. Those not used remained in good condition when released in 19° C water near the end of the cruise. They were fed a proprietary brand of "trout chow" twice a day.

Behavior of Tuna

On several occasions, small groups of tuna were seen swimming ahead of the Jordan for several hours. On one day, observations from the bow chamber indicated the presence of both yellowfin and skipjack; on two others, only skipjack. On one of the latter, the fish were sampled from the bow by hook and line using live anchovy bait; four specimens ranged from 60-64 cm. fork length.

The times of skipjack catches on the 2 vessels showed, as expected, the immediate post-dawn and predusk periods best for trolling--between 0600 and 0759, 19% of total catch; between 1700 and 1759, 30%. The postdawn percentage probably would have been greater but the 0600-0659 period was poorly sampled because of the transdawn trawling operations. Fish did strike at all other periods of the day but to a lesser extent.

Biology

Fork lengths (cm.) were taken, gonad maturity states noted, and stomach contents preserved for all fish landed. Skipjack ranged from 32 to 71 cm. (about 1-20 lb.) on Jordan, and 37 to 64 cm. on Cromwell. The Jordan data fall into 3 size groups: 32-40 cm. (mean 35.3 cm., n = 17), 45-50 cm. (mean 47.5 cm., n = 11), and 53.71 (mean 59.7.cm., n = 92). Cromwell data tend to indicate similar groups, although numbers are very much fewer, except for 54-60 cm. group (mean 57.3, n = 14). Ten skipjack, 53-68 cm., taken in 3°-5° N zone, were females with recently spent or spent-recovering gonads; of latter category, three females, 46 to 61 cm., were taken in 6°-7° N zone, and four, 59-64 cm., in 10°-11° N zone. All skipjack taken on Cromwell were immature.

Tuna Larvae and Juveniles

Twenty 15-minute neuston hauls were made from Cromwell, and 40 from Jordan. The Jordan samples were sorted on board ship, but these appeared to contain no tuna or billfish larvae or juveniles. On Cromwell 8, and on Jordan 10, midwater-trawl hauls of $1\frac{1}{2}$-hour duration were made around midnight to a depth of 30 m.; and, respectively, 11 and 9 hauls were made to 100 meters, or depth of 20° C isotherm if less than 100 m., spaced equally either side of marine dawn. On Jordan, trawl depth was monitored by telemetry from trawl warp transducers. Her trawl samples were roughly sorted on board; a 17 cm. Auxis (frigate mackerel) was only tuna observed.

Potential Skipjack Forage

Jordan made 42 tows with 5' x 5' net, Cromwell 44, to determine total micronekton and skipjack forage in Part I and II operations. The zooplankton samples from the 1-m. and $\frac{1}{2}$-m. CalCOFI nets, 38 on Jordan and 20 on Cromwell, and all midwater-trawl samples also will be examined in this respect.

Environmental Conditions

In addition to the Part I oceanographic transect, oceanographic conditions will be described for unit areas of Part II. In all,

for Parts I and II, Jordan made 122 XBT drops and 17 STD/Niskin casts; Cromwell made 58 XBT drops and 8 STD/Nansen casts for vertical profiles of temperature, salinity, and oxygen. Nansen casts also were made for STD calibrations.

Acoustic Data

On Jordan, acoustic data were collected on incidence of schools of large-fish targets, single large-fish targets, schools of small fish, and scattering layers. For most of cruise, thermal stratification was so shallow and abrupt that near-surface targets were not detectable with surface-mounted sonars. Single-fish targets were detectable to 150 m. lateral range (30 kHz, 10 m-sec pulse); in November, the incidence ranged from a rate of 180 per day (Nov. 15) down to 6 per day (Nov. 18). Many schools of small fish were detected on the sounder at depths of 260-400 m. On occasion, these schools also were detectable with long-range sonar due to downwelling sound-propagation conditions. The range in these instances was about 2000 m. (11 kHz, 30 m-sec pulse). Major layers were present near thermocline, and at a depth of 350 m. Maximum rates of migration were on the order of 16 cm./sec. vertical motion, with average rates of 6.5 cm./sec. 6 hours before and after local apparent noon. One school of Vinciguerria sp., an important forage species for skipjack, was detected near surface with the 11 kHz sonar at 900 m. range; later, the school was sampled by midwater trawl (15 x 15 m. trawl with 3 mm. bar mesh). No schools of large fish were detected.

Communications

In a two-vessel operation of this type, good radio communications are essential to coordinate efforts. Throughout cruise, Jordan was in contact with Cromwell and NMFS shore station WWD to transfer scientific data, weather, and general messages (CW, voice, teletype). In November alone, Jordan handled 718 messages. Jordan received daily facsimile (FAX) charts of eastern Pacific weather from Fleet Weather Central-Alameda, which included position of the Inter-tropical Convergence Zone. In addition, experiments continued with transmission by FAX of special weather and other charts and data from Fishery-Oceanography Center, La Jolla.

PRELIMINARY RESULTS AND SKIPJACK MIGRATION MODEL

At the time of this first cruise, the NECC was well developed in the area investigated. Recruit size skipjack mainly were caught in the NEC at 12°-14° N and, to a lesser extent, in NEC and SEC immediately adjacent to the NECC. They were not found in the NECC or in the SEC south of the equator. These findings are consistent with the model for this time of year.

FUTURE CRUISES

A second cruise to Area "A" using the Jordan is taking place from March 1 to April 12, 1971. The first cruise to Area "B" is planned for August 16 to October 8, 1971.

ACKNOWLEDGMENTS

I thank my colleagues who participated in the first of the present series of skipjack oceanography cruises, particularly R. Uchida, Cruise Leader on the Townsend Cromwell, and P. Smith and M. Tsuchiya for their comments on acoustic and oceanographic results, respectively.

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FACTORS AFFECTING EXVESSEL PRICES OF SKIPJACK TUNA IN HAWAII

Yung C. Shang

The skipjack-tuna industry in Hawaii is the most important segment of the state's commercial fisheries. However, the average annual catch of about 5,000 tons of this industry has remained relatively stable during the past two decades. The available evidence suggests that the lack of growth of this industry is not due to overfishing. On the other hand, the cost-revenue analysis indicates that, given the past input and tuna prices, the profit margins in the industry were too low to induce new investment.* The relatively high cost of inputs is associated with the labor-intensive fishing technique used and the bait problems. The main objective of this paper is to examine the factors affecting the prices of skipjack tuna.

Skipjack tuna vessels in Hawaii can be divided into two major groups: 10 of the vessels based on Oahu are members of the Tuna Boat Owner's Association; 2 others on Oahu, and 4 vessels on the other islands are operated independently.

Two major markets exist for the local catches: the fresh-fish market, and the cannery market. About one-third of the landings is consumed mainly as sashimi (raw fish). The remainder is canned and labeled as Coral Tuna--the only brand in the world canned from fresh tuna (not frozen).

Marketing Channel

The marketing channel varies among the vessel groups and among the markets (Figs. 1 and 2). Vessels belonging to the Tuna Boat Owner's Association utilize the Hawaiian Tuna Packers as the selling agency for fresh fish. The Hawaiian Tuna Packers usually has a representative contact the local wholesalers and wholesalers/retailers about their current needs for fresh fish. The United Fishing Agency acts as a selling agency for the other two vessels on Oahu and usually sells the fresh fish directly to wholesalers, wholesalers/retailers and, occasionally, through auction. The independent vessels on the other islands sell their catch to wholesalers and retailers through their local selling agencies. When the fresh fish market is fully supplied each day, the excess is sold directly by the independent vessels, and the members of the Tuna Boat Owner's Association sell the excess, through Hawaiian Tuna Packers, to the cannery at a set price, which is lower than price at fresh-fish market.

Fresh-Fish Market

The fresh-fish market for skipjack tuna in Honolulu consists of two major sellers, or selling agencies, Hawaiian Tuna Packers and United Fishing Agency, and a number of buyers--wholesalers and wholesalers/retailers. This is a duopolistic market--in which price determination is usually dominated by the sellers. Since the sellers have almost perfect knowledge about the market supply and demand, the price is usually set higher than the price which would be expected in a competitive market. The local fishermen have been receiving higher average prices than those on the U.S. West Coast for 2 reasons: price of fish in the fresh-fish market is much higher than price paid by the cannery, and because fresh-fish market of skipjack is the largest in the United States.

How Exvessel Price Determined

The exvessel price of market fish is assumed to be a function of its quantities supplied to the fresh-fish market, the quantities of yellowfin tuna (a higher-quality substitute for sashimi, raw fish), the quantities of other fresh fish, and the season. However, the results of the regression by using monthly data for 1958-1966 indicate that the quantities of yellowfin tuna and other fishes have no significant statistical effect on the exvessel price of skipjack tuna. The prices of skipjack tuna

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*Shang, Yung C., The Skipjack Tuna Industry in Hawaii: Some Economic Aspects, University of Hawaii, Economic Research Center, 1969.

are influenced primarily by the quantity supplied and the season.

The quantities supplied to fresh-fish market is a function of total landings in some months of the off-peak fishing season. Since supply is relatively scarce during this period, 100% of total catch is frequently sold to the fresh-fish market. The exvessel prices usually fluctuate with quantity supplied. During the peak fishing season, however, the quantities supplied to the fresh-fish market, which accounts for a small proportion of seasonal catch of skipjack tuna, are at a relatively high level and at a relatively low and stable price.

The market demand for fresh skipjack tuna is not likely to increase significantly in the future because there is no positive significant relationship between the per-capita consumption and the per-capita income. Therefore, the development of this fishing industry relies on the cannery market.

Cannery Market

The skipjack tuna cannery market in the landing level in Hawaii consists of one buyer, Hawaiian Tuna Packers, and a number of sellers--a monopsony market. In this monopsony situation, price determination is usually dominated by the buyer. In the short run, the exvessel prices paid by the local cannery do not fluctuate with the catches. They are set for a longer period. The cannery buys all excess catch at set prices that cannot be absorbed by local fresh-fish market. Therefore, the cannery demand curve is approximately a horizontal line with a perfect elasticity of demand within a certain period.

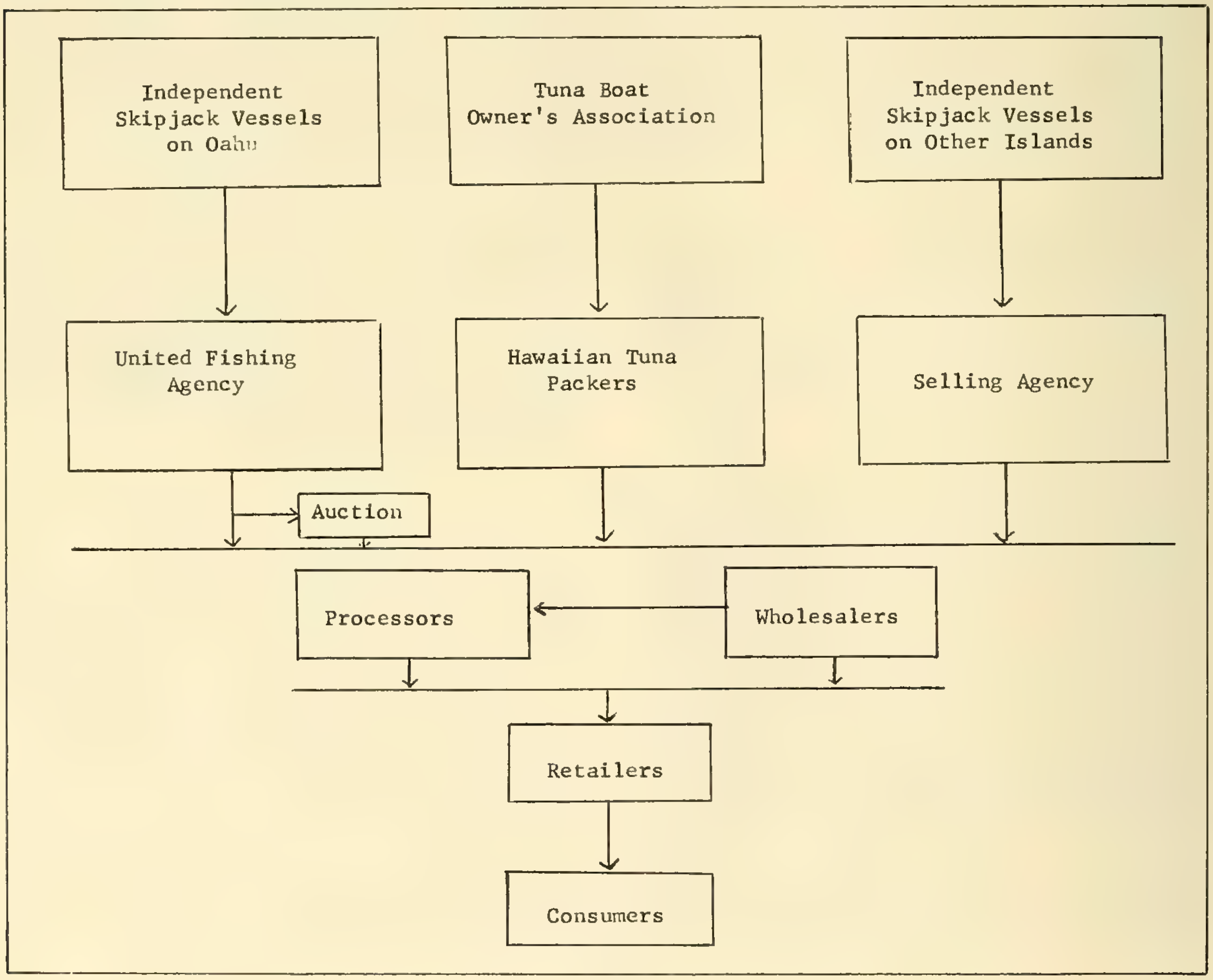

Fig. 1 - Marketing channels to the fresh fish market.

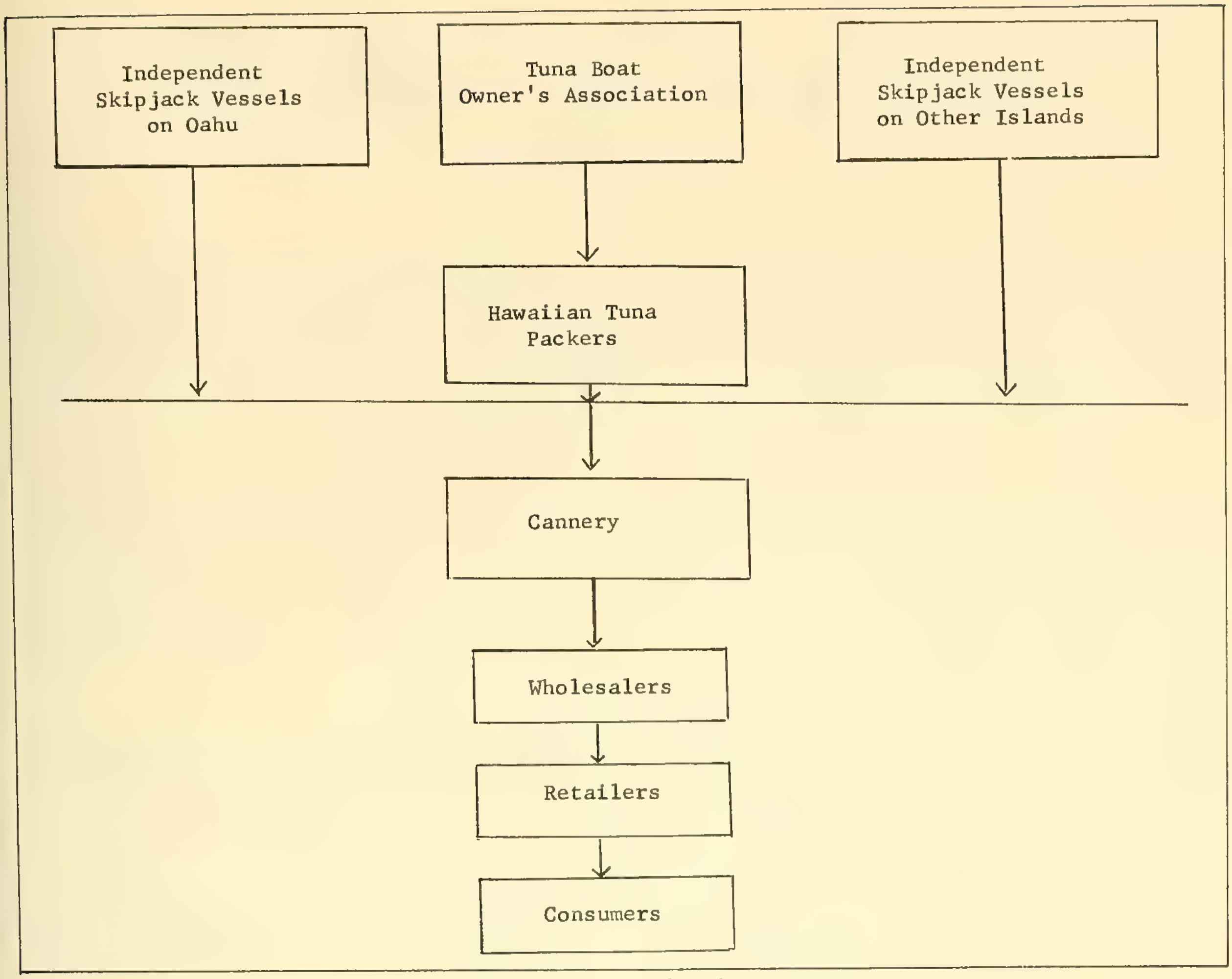

Fig. 2 - Marketing channels to the cannery.

Canned tuna packed from local catches has to compete with the mainland packed tuna in the local and mainland markets. The exvessel price paid by the local cannery does not fluctuate monthly. However, when the average exvessel price of skipjack tuna on the U.S. West Coast increased in recent years, the level of local price paid by the cannery also increased. On the West Coast, the prices of skipjack follow the prices of yellowfin. The coefficient of determination (R^2) of the regression is 0.98. This indicates that these two prices are moving up and down very closely. The difference between these two prices is about $50 per ton.

The exvessel prices of domestic yellowfin is a dominant factor in determining the exvessel price of skipjack tuna on the West Coast. This, in turn, imposes limits on the highest price that can be paid by the local cannery. So local fishermen are not able to increase their profit simply by raising the price of fish to a large extent. The profit should be increased mainly by reduction of costs through improvements in fishing technique.

Acknowledgments

I thank Mr. Tamio Otsu, Hawaii Area Fishery Research Center, National Marine Fisheries Service; Mr. Scott McLeod, Hawaiian Tuna Packers; and the late Professor Vernon E. Brock, University of Hawaii.

GEAR NOTE: With this device, inexperienced man can haul sablefish pot in about 8 minutes.

A BUOYLINE COILING DEVICE

Ian Ellis and Gary Loverich

A new device of significant value for high-speed coiling of buoylines has been developed in a joint program by the Seattle Exploratory Fishing and Gear Research Base and Captain Sig Jaeger, owner-operator of the commercial fishing vessel M/V 'Seattle'. The device is a modification added to a standard pot hauler, the "MARCO* JO105 crab block."

The need for this device became apparent during an experimental pot fishery for sablefish in the coastal waters off the State of Washington. This fishery has been conducted in waters with an average depth of 275 fathoms and, at times, up to 375 fathoms, using 400-fathom or longer buoylines. Initially, without a line-coiling aid, one man was required to tend the pot hauler and another to coil the lines by hand. Experienced fishermen took 12 to 14 minutes to haul a sablefish pot while inexperienced men took about 18 minutes. Using the device described in this report, an inexperienced man working alone could haul a pot in about 8 minutes.

Line-Coiling Device

The line-coiling device consists of a guiding channel that receives and guides the line after a splitter picks it off the main sheave of the block and guides it into a fiber-reinforced rubber discharge hose (Fig. 1). The operator stands facing outboard with his left hand manipulating the hydraulic control for the block, and his right hand directing the discharge hose to place the line in a neat coil at his feet (Fig. 2). A spring-loaded steel finger with a grooved face holds the line tightly in the main sheave when the incoming line is slack (Fig. 3). This steel finger can be easily engaged or disengaged by the operator with his left hand while coiling the line and without interrupting the smooth hauling of the pot. A knot passes freely around the main sheave and under the steel finger. If the knot will not clear the guiding channel and discharge hose, the operator can quickly remove the line from the hose, pull enough slack past so the knot is clear, and rethread the line in the hose (Fig. 4).

Early in the development of this device, the idler sheave was removed from the discharge side of the main sheave and a spring-loaded wheel with a grooved nylon face was installed to hold the line tightly in the main sheave (Fig. 5). This wheel was subsequently removed and replaced by the present steel finger, which does the job equally well and takes less space.

The idler sheave was reinstalled to facilitate setting groundlines. When setting, the groundline is paid out over the crab block with the idler sheaves holding the line in place under tension on the main sheave.

Since an erratically swinging block makes coiling difficult, the block in its present configuration is hung centered over the rail and secured in place to stop this action. Two crossed braces are attached to the block at points behind the idler sheaves and bolted to a bracket welded to the rail. The buoyline is led into the crab block from a lead block suspended outboard by a chain fastened to the rail. When traveling, the bolts at the rail are removed and the unit swings inboard.

Initially, the crab block was suspended much further outboard, and the guiding channel redirected the line through a much sharper angle. The lead roller arm was therefore modified (Fig. 3) to eliminate chafing when the line came up at an angle.

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*The use of trade names does not imply endorsement of a firm or product.

COMMERCIAL FISHERIES REVIEW
Reprint No. 904

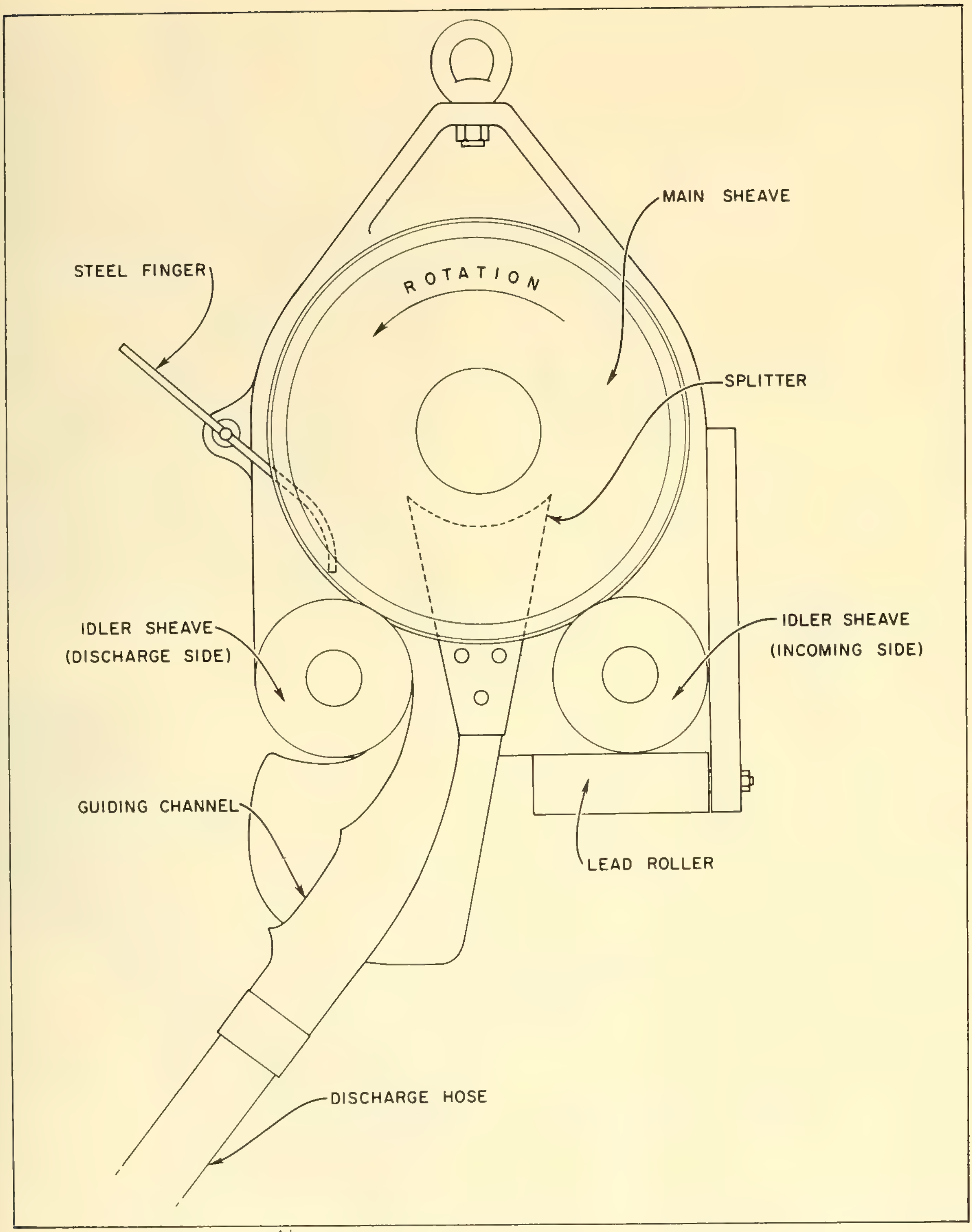

Fig. 1 - MARCO[1/] JO105 crab block with modifications to aid in high-speed line coiling.

[1/]The use of the name MARCO does not imply endorsement of a firm or product.

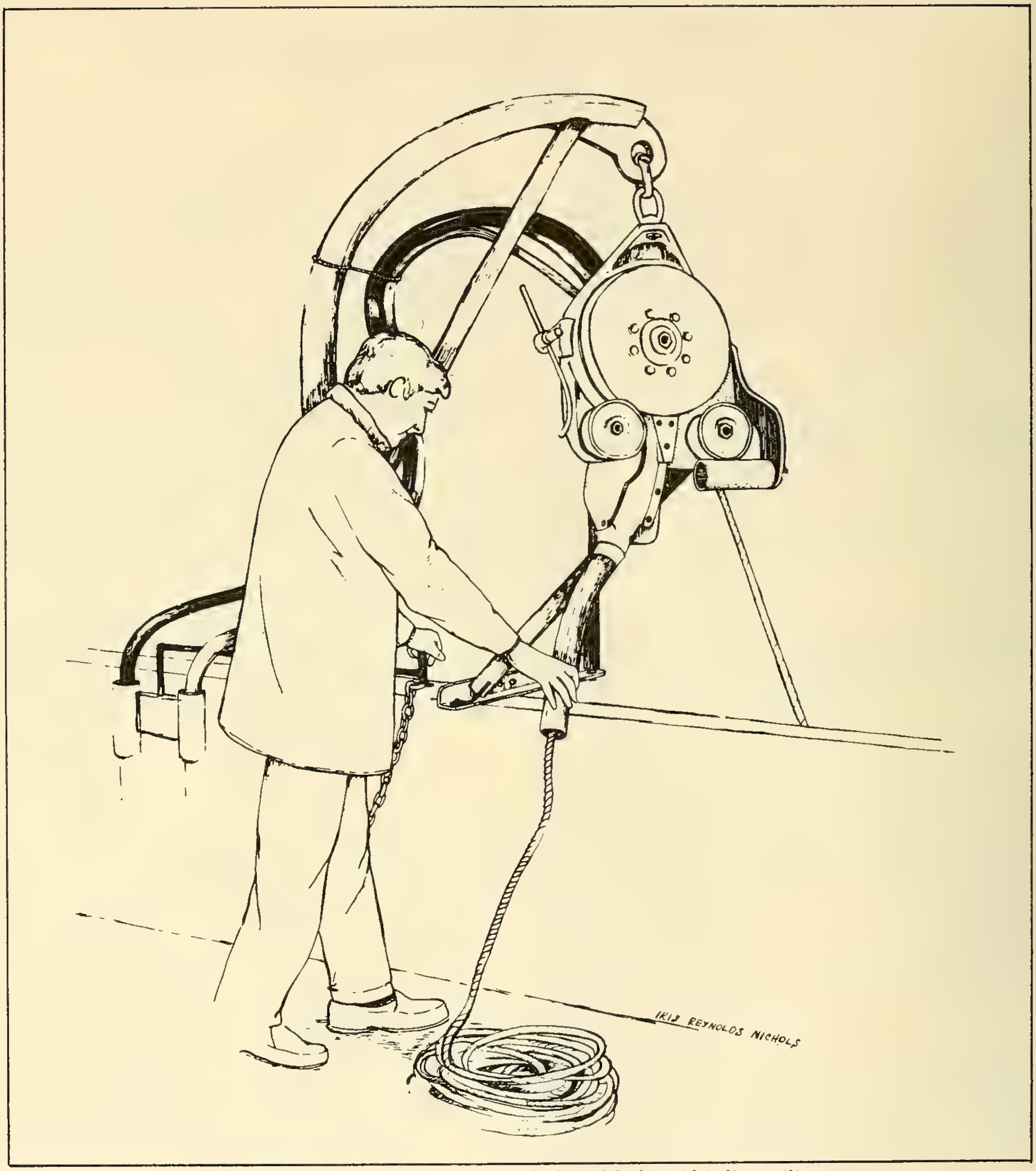

Fig. 2 - Method of operation of a crab block modified to aid in line coiling.

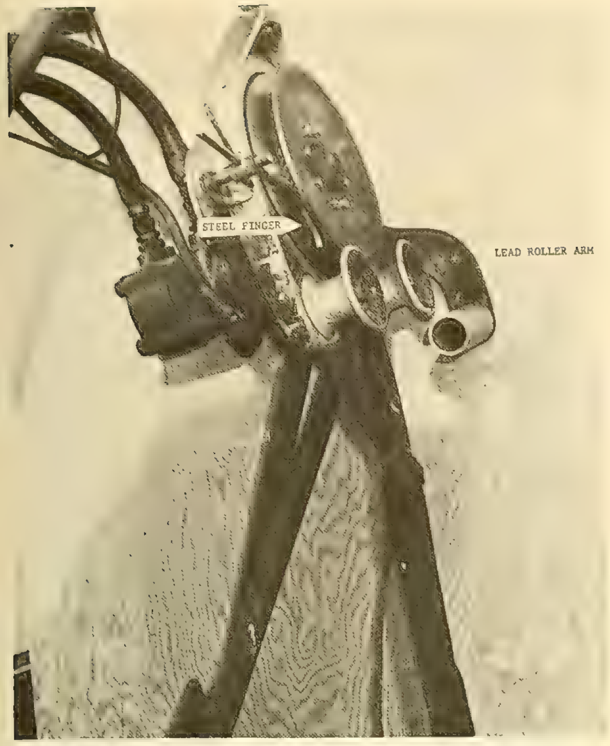

Fig. 3 - Crab block with line coiler showing the spring-loaded steel finger holding the line in the main sheave.

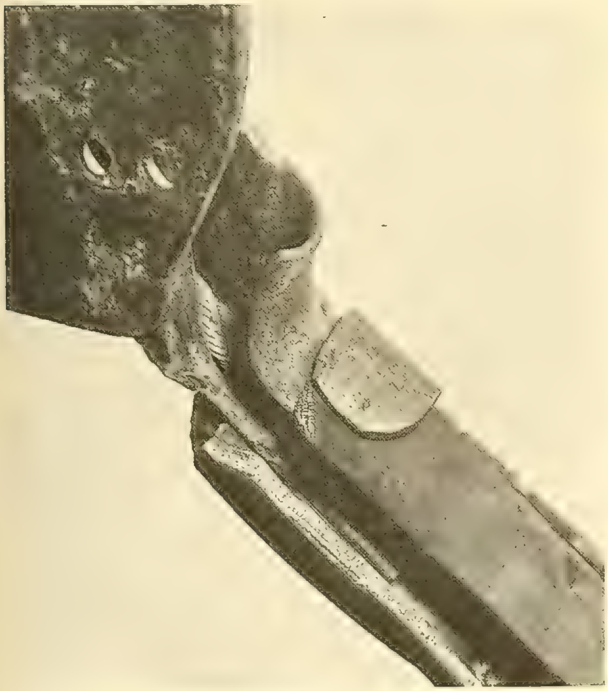

Fig. 4 - Discharge hose and lower end of guiding channel showing the slot for threading and removal of line. (Photos: William L. High)

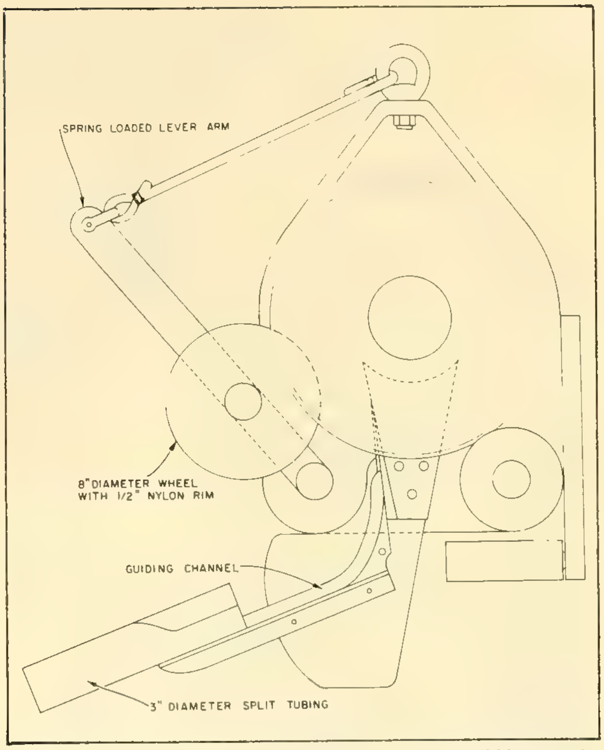

Fig. 5 - Crab block with spring-loaded wheel to hold line in the sheave.

System's Advantages

In summary, the line coiling device is very effective for deepwater pot fishing. The chief advantages of this system are:

1. The operation of the block and the coiling of the line are carried out by a single crew member.

2. The crab block may be operated continuously at full capacity, thus reducing the hauling time.

3. The line-coiling device is a simple modification to an existing, proved piece of fishing equipment.

4. The modification to the crab block can be accomplished by almost any shop having welding and burning facilities.

5. Little experience is required to operate the line-coiling device.

The line coiler has been employed successfully on the blackcod pot fishing vessel 'Seattle' for several fishing trips.

TECHNICAL NOTE

FISH PROTEINS AS BINDERS IN PROCESSED FISHERY PRODUCTS

R. J. Learson, B. L. Tinker, and L. J. Ronsivalli

The binding role of proteins has been well established for emulsified products such as frankforts and baloney. Much work has been done on the water-holding capacity and emulsification properties of beef and poultry proteins.

The Japanese have worked on the binding properties of fish proteins in fish sausages and the traditional Kamaboko, which are also emulsified or gelled products.

Recently in the meat and poultry industry, there has been interest in binding together pieces or chunks of flesh to produce loaves or rolls. The need for binders in these fabricated foods has initiated much research into a host of protein materials. These include soy protein, gluten, gelatin, milk solids, and egg whites.

At the Fishery Products Technology Laboratory in Gloucester, Mass., we became interested in the binding properties of fish proteins to increase the structural stability of fish fillets exposed to various thermal processes. Research showed that when fillets were coated with a slurry made from diluted fish muscle their physical structure was unaffected by thermal processing and storage at temperatures above freezing.

The following describes some of the research on the use of fish proteins as binders in new-product development.

THE FORMATION OF ROLLS OR LOAVES

Research was carried out to develop roll or loaf-type products incorporating other fishery products as flavoring agents. Haddock and cod fillets were comminuted (pulverized) for various times in a silent cutter (30-180 sec). Pieces of shrimp and clams were incorporated into the ground muscle and the mixtures were placed in No. 2 cans. The cans were sealed and heat-processed to internal temperatures ranging from 50 to 100° C. The resulting product, Figure 1, was a solid mass of flesh physically stable at above-freezing temperatures. For taste-testing, the rolls were sliced into 1.5 cm. portions, lightly breaded and deep-fat fried.

In general, these products were considered highly acceptable by the test panel. The flavor of the products was considered to be that of clam or shrimp and not haddock or cod. The texture of the products appeared to be related directly to the amount of grinding or the particle size of the ground fish muscle. Fish muscle comminuted for 30 seconds resulted in very little binding, whereas muscle treated for 3 minutes produced an almost rubbery texture. The heat treatment needed to bind the flesh did not appear to be critical. Highly acceptable products were prepared by heating them to internal temperatures as low as 50° C and up to 77° C. Products heated to internal temperatures above 77° C had a tendency to be dry and slightly discolored. This was especially true of heat-sterilized products.

Other products of this type were prepared using various flavoring agents such as ocean quahogs, Maine shrimp, and crab meat. All these were highly acceptable.

REFORMATION OF CRAB MEAT

As part of our blue-crab research program, we continued this line of research to develop new products from crab meat. Flake

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COMMERCIAL FISHERIES REVIEW
Reprint No. 905

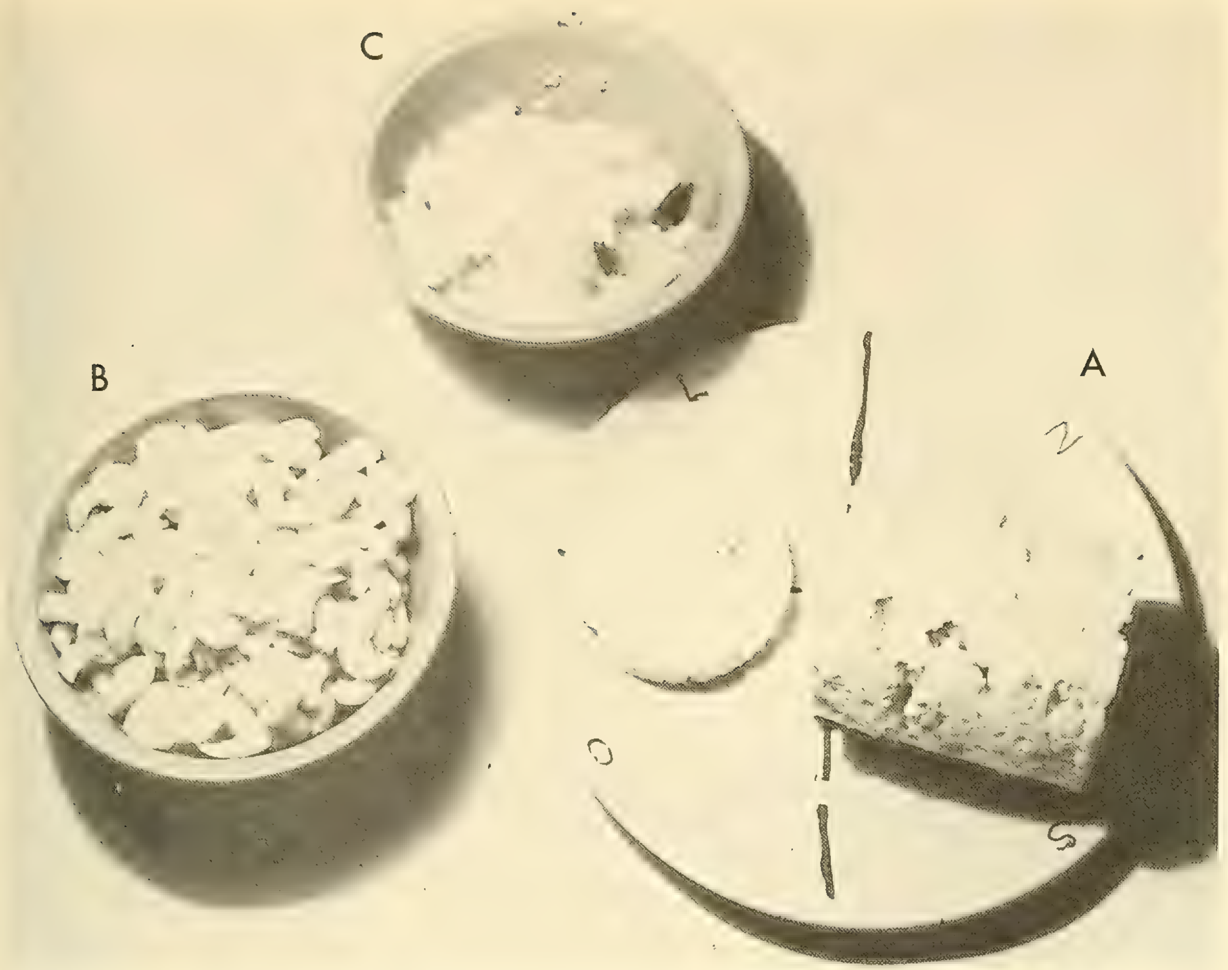

Fig. 1 - Shrimp roll (A) prepared from Maine shrimp (B) and diluted comminuted fish muscle (C).

meat, the meat picked from crab bodies, is much less desirable than the solid "back fin lump" meat. It is also more difficult to pick, resulting in an adverse effect on quality, especially with increasing labor costs. For this reason, the industry is moving towards machines to remove the meat from the bodies. To date, these machines show a tendency to break up the meat, making it less desirable for the salad or cocktail market.

Using a fish protein binder, we attempted to upgrade the broken flake meat to something similar to the desirable "back fin lump" meat now produced by the industry. A binder was prepared by grinding fish muscle in a silent cutter and mixing this with commercial-grade flake meat. The product was formed to the desired shape and sealed or bonded by steaming. A number of formulations and processing conditions were tried in an attempt to produce exactly the right texture--the texture of a solid piece of flesh. The texture of the finished product appears to be related to three interdependent variables: the size of the particles in the binder, the moisture content of the product, and the heat treatment. The binding property and product elasticity increased with decreasing particle size and decreasing moisture content. The application of heat decreased the moisture content and increased the binding property. The most acceptable product was prepared in the following manner:

Haddock or cod fillets were comminuted in a silent cutter for 60 seconds. The binder was prepared by mixing 8 parts fish flesh to 2 parts water. Commercial blue-crab flake meat was mixed with the binder at a ratio of

9 parts crab meat to one part binder. The product was formed and treated in steam for one minute to seal the binder. This product had the texture of a solid piece of flesh and there was no organoleptic evidence that anything but crab meat was added. Although we called this product "simulated lump meat", there was really no comparison with "real back fin" lump meat, and it certainly cannot be substituted for the genuine "back fin" lump. However, the product was considered far superior to the original flake meat in terms of versatility, and the fact that it did not break up during packaging and handling represented important advantages over the lump meat. To demonstrate this versatility, we prepared a number of products using the simulated lump meat. These included smoked crab (lump meat prepared with liquid smoke), crab cocktail, fried lump meat, and a simulated soft-shell crab (Figures 2 and 3). All these were considered highly acceptable by members of the industry as well as by taste panels at the laboratory.

Since most of this work was carried out on cod and haddock muscle as the binder material, we decided to test a number of fish species to determine if there were differences in binding characteristics. An experiment was carried out where a crab-meat product was prepared using a number of fish species as the binder. All the products were prepared using the previously described procedure. To give an indication of the relative binding power, the force necessary to penetrate the product was measured for each binder. This was done by measuring on a gram scale the pressure required to pierce the product with a steel shaft (flat end--diameter = 0.5 cm). The binders tested included flesh from cod, haddock, flounder, ocean perch, whiting, hake, skate, white perch, skup, mullet, sea trout, butterfish, striped bass, and raw crab flesh. We also tested haddock binder (80% haddock, 20% water) stored for 10 days at 1° C and 11 days at -20° C. Within the accuracy of the experiment, we found no significant differences among fish samples. The crab flesh, however, had binding properties far less than the fish flesh. To achieve the same product elasticity, a heat treatment of 25 minutes was required. This compares to a one-minute heat treatment for the others.

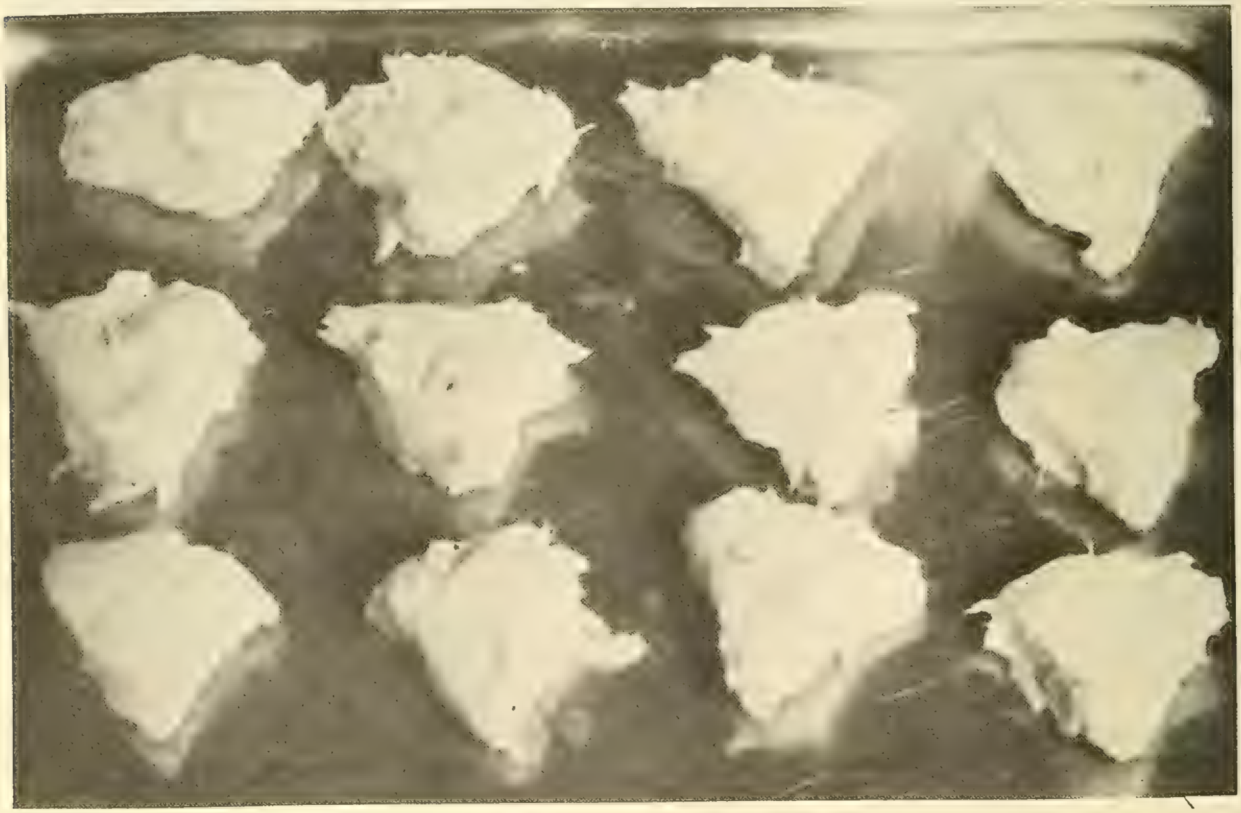

Fig. 2 - Simulated blue crab lump meat prepared with 90% flake meat and 10% fish protein binder.

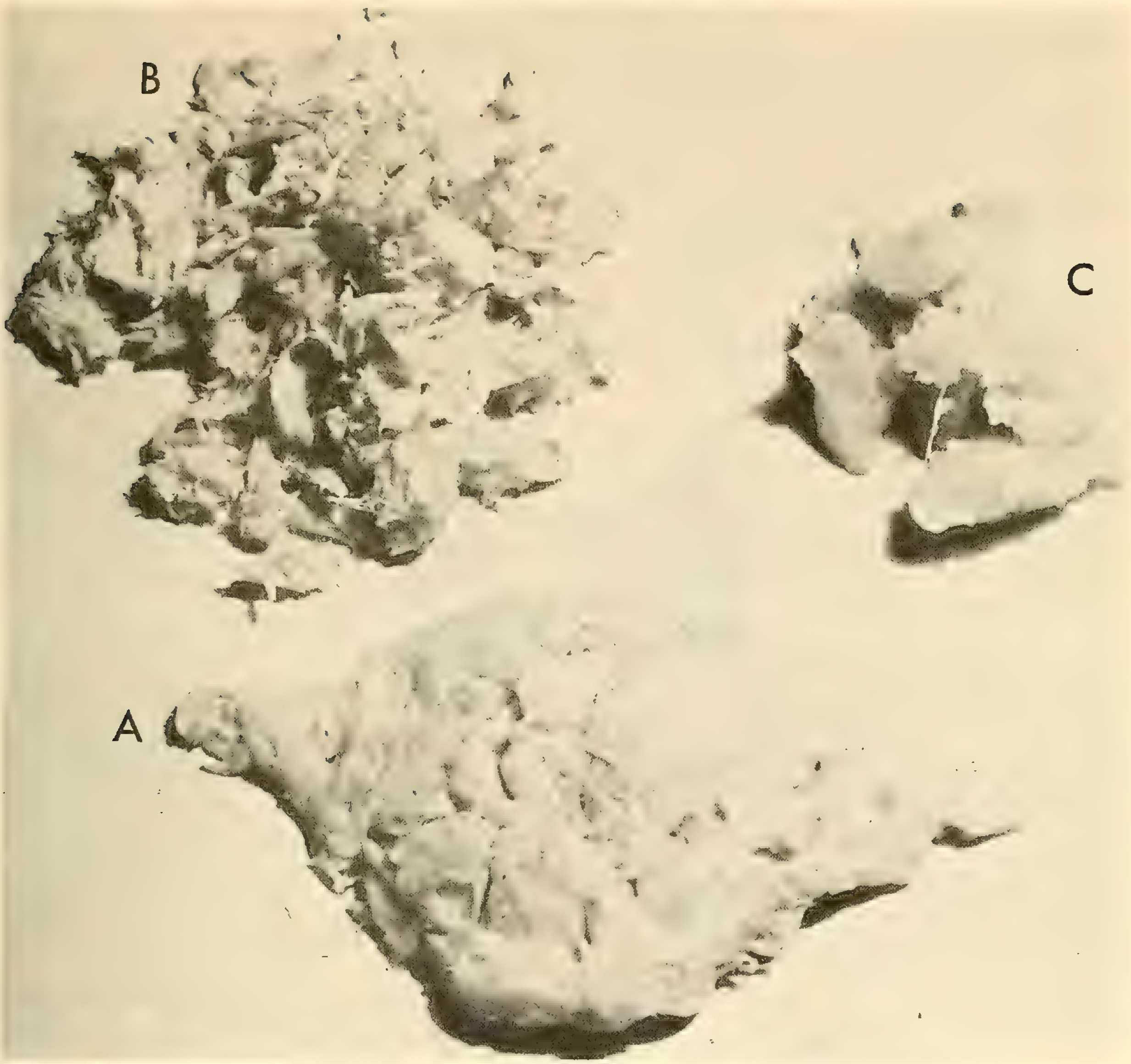

Fig. 3 - Simulated soft shell crab (A) prepared with 90% flake meat (B) and 10% fish protein binder (C).

SUMMARY

In general, all our data indicate that the role of fish proteins is similar to that theorized for meat. The application of heat produces an unravelling of the protein and random cross linking by means of hydrogen bonding. The cross linking of randomly organized protein mixed with connective tissue is responsible for the tightly adhering mass.

So, in general, it appears that a fish-protein binder can be used effectively in the development of formed fishery products. The binder material is cheap and easy to obtain by means of meat/bone separators. It is reasonably stable at both refrigerated and frozen temperatures. It can be flavored and colored and, finally, it is a protein natural to fishery products and readily available to fish processors.

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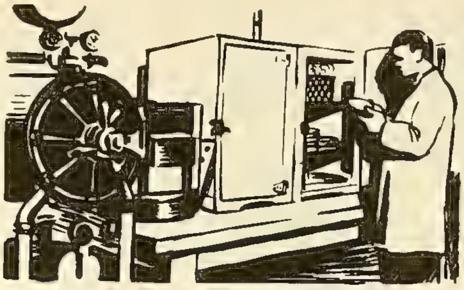

GLUCOSE OXIDASE REDUCES OXIDATION IN FROZEN SHRIMP

Carolyn Kelley

Glucose oxidase-catalase, an oxygen-utilizing enzyme system, has been used successfully to decrease oxidation and loss of color in frozen Alaska pink shrimp.

Oxygen plays an important role in many of the problems of modern food processing. The oxidative rancidity in fat-containing foods and discolorations or loss of color in many foods can be attributed, at least in part, to oxygen. Freezing rather than canning, convenient small-size portions, and the use of cartons and bags rather than cans or glass have all accentuated the destructive role oxygen can have during storage of foods (Scott, 1958).

Glucose oxidase-catalase preparations are used to carry out the net reaction: 2 glucose + oxygen $\xrightarrow[\text{catalase}]{\text{glucose oxidase}}$ 2 gluconic acid. The reaction proceeds until either the glucose or oxygen is all used (Scott and Craig, 1967).

MATERIALS AND METHODS

A commercial enzyme Ovazyme (1) preparation was used. Two solutions were prepared containing equivalent amounts of this enzyme, one to be used in place of the usual brine dip, and the other to be added in small amounts directly to the cans.

Precooked, machine peeled, blanched (ready-to-eat) Alaska pink shrimp were used for samples. Enzyme solutions either were put into the cans and the shrimp added, or shrimp were dipped into an enzyme solution before being put into the cans. Several amounts of the enzyme solution and various dip treatments were used to determine the most effective amount of glucose oxidase to have in the can. Cans were sealed without vacuum and left at ambient temperature (45-50° F) for 30 minutes for the enzyme to act before samples were frozen at -20° F. After about 24 hours, the cans were transferred to 0° F storage and analyzed at given intervals for rancidity development and loss of color. The storage study was planned to last six months, but the samples stayed unexpectedly fresh so the time was extended to a year.

Analyses for rancidity were done by the TBA method of Yu and Sinnhuber (1967). Color was determined by the method of Kelley and Harmon (1971).

RESULTS

Analyses for rancidity showed that glucose oxidase in any amount tried was effective in reducing rancidity when shrimp was dipped

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(1) The use of trade names is merely to facilitate description; no endorsement is implied. Fermco Labs, Chicago, Ill., donated the Ovazyme.

COMMERCIAL FISHERIES REVIEW
Reprint No. 906

in it, or when it was added to the can. After the year of storage, the untreated control sample has a rancidity value of 1.32, and treated samples values ranged from 0.71 to 0.98. The loss of color in the untreated control was 29.1%, and treated samples ranged from 9.0-20.0% loss of color.

SOME THOUGHTS ABOUT THE WORK

Loss of color is usually not as large when shrimp are not exposed to light. The benefits of glucose oxidase-catalase would probably be more obvious in shrimp, which were packed in transparent bags rather than cans.

In this work, rancidity was less with larger amounts of glucose oxidase-catalase present. The removal of oxygen in the closed container is a function of both amount of enzyme present and time in which enzyme was active. The effectiveness of the glucose oxidase-catalase could probably be increased if optimum amounts, delay time, and temperature requirements were identified for given container sizes. If, for economic reasons, it were desirable to reduce the amount of glucose oxidase-catalase, a longer time between sealing and freezing would probably compensate for the smaller amount of enzyme.

It remains unknown whether freezing completely inactivates the enzyme system. Some unreported work in connection with this study indicated that the enzyme may become active again if the closed container is brought back to ambient temperature for a while. If this proves true, glucose oxidase-catalase may be especially useful for removing trace oxygen during shipment when temperatures may fluctuate considerably and oxidation could occur.

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WORLD FISH MEAL PRODUCTION RISES

During Jan.-Sept. 1970, fish-meal output by major producers-exporters, Peru, Norway, and Chile, totaled nearly 2.6 million short tons; the figure was 1.8 million in 1969 period. The 3 nations export about 97% of their output and account for about 75% of world exports. This was reported in "Foreign Agriculture," U.S. Dept. of Agriculture, Jan. 11, 1971.

Their combined exports during Jan.-Sept. 1970 were 2.1 million tons--only 47,000 tons above 1969 period--and 487,000 tons less than production. In 1969, exports at just over 2 million tons had exceeded production by over 200,000 tons. A substantial buildup in stocks occurred in 1970. The last time it happened was in 1967. That was followed in 1968 by heavy stock dispersals, which boosted exports to 5% over production.

Imports by 'Big 8' Drop

The 1969 decline in imports into 8 selected countries continued through the first 9 months of 1970. In the past, the '8' had taken bulk of imports. The decline resulted from relatively scarce supplies and high prices that began in May 1969.

Imports by the '8'--at 1.4 million tons for Jan.-Sept.--were down 365,000 tons (20%) from level of 1969 period. When compared with exports, 600,000 tons remain unaccounted. This may reflect, in part, the lag between export and import data; and, partly, possibility that larger quantity is probably moving to other importing countries in East and West Europe.

Agriculture Dept. Observations

Although 1971 fish-meal production "is indeterminate," says U.S. Department of Agriculture, several observations can be made:

(1) Aggregate fish-meal production in the three major countries trended upward at annual average volume of 246,700 short tons during 1960-68 period.

(2) Their production since 1960 increased in 7 years and declined only in 2--1965 and 1969.

(3) Exports from the three have accounted for over 95% of combined output. During 1960-68, it trended upward at volume of 243,900 tons annually.

(4) Export availabilities in 1971 from 1971 production would amount to 2.7 million tons--if 1971 production does no more than stagnate at 1970 volume, currently estimated at 2.85 million tons, and local use continues at about 150,000 tons.

(5) Also, a substantial quantity of fish meal (roughly 380,000 tons) accumulated in 1970 will be available for export.

(6) Although aggregate imports into major consuming countries declined sharply in 1969, and continued to decline in 1970, imports into all countries, except U.S., were well maintained through 1969. Only in 1970 was decline in fish-meal availabilities felt in major consuming countries. This indicates that U.S. exports of soybeans and meal were not affected by 1969 decline in fish meal availabilities--but did benefit significantly from reduction in 1970.

(7) In 1970, fish-meal production may have reached record. However, as before, impact of large production would not be felt in consuming countries until 1971.

JAPANESE ARE PESSIMISTIC ABOUT 1971 FISHERY EXPORTS

The Japanese fishing industry is apprehensive over recent U.S. actions banning the sale of mercury-contaminated fishery products. In 1970, Japan sold to the U.S. 3.3 million cases of canned tuna worth about US$36 million. This was almost 10% of all fishery exports. Exporters expect U.S. purchases to drop to practically nothing while the mercury problem is studied in the U.S. The same is true for frozen tuna and swordfish.

The U.S. also has banned imports of whale meat and oil under the Endangered Species Act. ('Japanese Economic Journal', Jan. 19, 1971.)

Although exports of whale products to the U.S. were worth only $2.5 million in 1970, the ban will hit whalers hard for 2 reasons: there is a high profit ratio in the sale of whale products, and the industry already is troubled.

Canned Tuna No. 1

Canned tuna is Japan's most important fishery export. In 1969, sales expanded 20% to $66 million. More than half was bought by the U.S., the rest by West Europe. Japanese sources report several European Community nations, particularly Italy and France, are considering minimum import prices for Japanese canned tuna to protect domestic producers.

Japanese frozen tuna exports to the U.S. were worth $35 million in 1969.

On Jan. 20, 1971, the U.S. National Fisheries Institute announced that under provisions of existing contracts 5 million lbs. of frozen swordfish, worth $2 million, would be returned to Japan because of high mercury levels. The swordfish can be sold in Japan if the government permits. ('Japan Times', Jan. 22, 1971.)

W. German Situation

West Germany, too, is seriously concerned about mercury-in-tuna situation. A movement is under way to prohibit sales of canned tuna containing more than 0.4 part mercury in a million parts of canned tuna. Some buyers are demanding that Japanese exporters of canned tuna attach certificates attesting less than 0.4 ppm mercury.

The move by West Germany to establish a more rigid standard than the U.S. apparently is aimed at preventing the diversion of U.S.-rejected shipments to W. Germany.

Japanese exporters claim they cannot comply with German demand because Japan's position is not to issue individual certificates for canned tuna exports. The West German move will hurt because W. Germany is Japan's second-best canned-tuna market (after U.S.) and best market for Japanese canned tuna in oil. ('Suisan Tsushin', Jan. 14, 1971.)

NMFS Comment: Japan used to be net exporter of fishery products. During last few years, it has imported more and more. In 1969, fishery imports increased 30% over 1968 to $261 million; exports decreased 2% to $347 million. The continued rapid decrease of exports could severely affect fishery trade balance.

JAPAN

FISHERY BUDGET IS RAISED FOR FISCAL YEAR 1971

The Japanese Government approved on Dec. 30, 1970, the Fisheries Agency budget of 50,052 million yen (US$139 million) for fiscal year (FY) 1971 (April 1971-March 1972). The requested sum is 23.7% higher than the FY 1970 fishery budget of 40,462 million yen ($112.4 million).

Some Large Increases

The Agency is requesting large increases for: improvement of fishing ports (26.3%); development of deep-sea fisheries (53.4%), which includes establishment of a $278,000 marine fishery center; and a marketing program including a $47,000-subsidy for experimental tuna marketing.

For first time, the Fisheries Agency is seeking funds to control pollution on fishing grounds ($267,000).

Amounts for some programs are shown below. ('Nihon Suisan Shimbun', Jan. 6, 1971.)

Program	Proposed FY 1971 Budget	FY 1970 Budget
	(US$1,000)	
Fishing ports improvement	75,917	60,105
Fishing industry disaster compensation system	4,530	6,411
Fishermen disaster compensation system	4,423	4,409
Deep-sea fisheries development	3,490	2,275
Fishery products marketing program	2,083	1,062
International fisheries biological research	816	700
North Pacific fisheries enforcement	778	592
Distant-water fisheries enforcement	552	511
Fish culture center	479	435
Fishing ground pollution control	267	-
Marine resources conservation	235	201
Fish culture experimental projects	145	187
Coastal/offshore fisheries forecasting	84	83
Other	45,201	35,429
Total	139,000	112,400

* * *

SAURY PRICES RISE AS LANDINGS FALL

Saury prices in Japan have risen sharply in recent years as landings declined. Once considered poor man's food, the saury now is high priced.

In 1969, landings declined 60% from 1968 and reached a record low of 52,200 metric tons; the average exvessel price tripled. So earnings of vessel owners suffered less than had been expected.

Earlier Season Opening Suggested

Still, saury fishermen want to increase the catch to make the fish available to all. Fishing captains have suggested an earlier season opening. ('Shin Suisan Shimbun', Feb. 1, 1971.)

* * *

SQUID FISHING OFF U.S. EAST COAST IMPROVES

Japanese trawlers fishing squid off New York since late Nov. 1970 reported in Jan. 1971 that fishing had improved. Earlier reports had indicated that about 14 trawlers were having difficulty finding good concentrations. Although January catches were still

JAPAN (Contd.):

below 1970 peak-season catch, some vessels were hauling in close to 10 metric tons a day.

European Price Drop

The Japanese firms hope to export squid to Europe at US$400/metric ton (cost, insurance, freight). However, the European price will almost definitely decline to $300/ton level, about half the 1969 price. The Japanese fear they may not be able to make any profit.

Butterfish & Argentine

Prior to squid, the trawlers concentrated on butterfish and argentine. In early Jan. 1971, 1,800 tons of East Coast catch (1,400 tons butterfish, 400 tons ocean perch and argentines) arrived in Japan. There the butterfish packed in 44-lb. boxes brought 5,800 yen ($16.11) a box wholesale. ('Minato Shimbun', Jan. 14, 1971.)

. . .

NMFS Comment: The Japanese wholesale price for butterfish was $0.37 a pound. Recent U.S. prices were:

wholesale Baltimore US$0.35
wholesale New York US$0.35-40
retail Baltimore (Dec. 1970) US$0.69-0.79.

* * *

REPORT ON SHRIMP INDUSTRY TRENDS

About 70 Japanese shrimp trawlers were fishing in the Caribbean Sea off the Guianas (South America) in Jan. 1971. The trawlers began organized fishing 4 years ago. They lost money because their crews were not familiar with the grounds.

Over the years, however, crew skill improved steadily, mechanical refrigeration was installed. Now most trawlers are operating profitably.

1970 Catch

In 1970, their combined shrimp catch off the Guianas was 5,768,190 pounds--about 5% above 1969 catch of about 5.5 million pounds.

The catch, mostly pink and brown shrimp, is exported to the U.S. and Japan. ('Suisan Keizai Shimbun', Jan. 27, 1971.)

Prices Firm in Japan

Frozen shrimp wholesale prices in Japan generally are holding firm. Prices for large sizes, in short supply, continue high due to strong institutional demand. But the plentiful smaller sizes, particularly 31-40 counts, are steady. ('Suisan Tsushin', Feb. 3, 1971.)

* * *

IMPORTS OF FROZEN SHRIMP FROM AFRICA ARE INCREASING

In 1970, Japanese imports of frozen shrimp from Africa, especially from Nigeria and Senegal, increased. During 1969, Japan imported 530 metric tons from Nigeria, 286 tons from Senegal, 104 tons from Tanzania, and 47 tons from Mozambique.

Liberia, Ivory Coast, Gabon, and Cameroun also supplied shrimp in 1970. Although the quantities were small, Japan expects shipments to increase because of Japanese exploratory fishing off Gabon and Cameroun.

Senegal Largest Supplier

In 1970, Senegal was the largest west African supplier of shrimp to Japan: 238 tons in Jan.-July. In 1967, Tomen, a Japanese trading firm, began to import frozen shrimp from Senegal; by Sept. 1970, it had reached 50 tons. Tomen believes that only significant catch improvement will make it profitable for Japanese to fish off Senegal.

Shrimp from Senegal are mainly white with a predominant count of 26 to 30 and 41 to 50, heads on, per pound. The Japanese market for these is good. Shrimp with a count of 50 or over, heads on, are exported to Europe. ('Suisan Keizai')

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NMFS Comment: Imports of shrimp from Africa are small part of Japanese shrimp imports: 3.1% in 1969. Total 1969 Japanese imports of shrimp were 48,885.7 metric tons worth US$121,747,500. In 1970, these fell to 45,187.4 MT worth US$106,835,833 (Africa 3.4%).

But imports from Africa are increasing rapidly. In 1969, six African countries exported 1,734 metric tons worth US$3.7 million. According to Japan, Madagascar led

JAPAN (Contd.):

with 760 tons, followed by Nigeria, 530 tons; Senegal, 286; Tanzania, 104; and Mozambique, 47. Somalia exported negligible amount.

During first 9 months of 1970, significant changes occurred. Five countries joined the 6 that exported in 1969: Ivory Coast, 137 tons; Liberia, 36 tons; Gabon, 27; Cameroun, 8; Angola, 1. Madagascar remains chief supplier, 790 tons, but imports from Nigeria have decreased significantly, to 212 tons. This contradicts information supplied by 'Suisan Tsushin'. Imports from Senegal fell to 272 tons in first 3 quarters of 1970.

It appears that the Japanese, to maintain African shrimp supplies for ever-increasing domestic demand, are rapidly establishing joint ventures in most coastal African countries.

* * *

HIROSHIMA OYSTER GROWERS WORRY ABOUT S. KOREAN IMPORTS

In Jan. 1971, when oyster harvest was at its peak, the Hiroshima oyster growers worried about imports from Republic of Korea (ROK) by a Japanese firm.

For about a year, the San-ei Suisan, Hiroshima's largest wholesaler of oysters, had been culturing oysters in Korea, with ROK support, in waters much cleaner than Hiroshima's.

S. Korean Oysters

In 1970, the wholesaler had imported from ROK 30 metric tons in the shell and shucked them (yield 4 tons of meats). A small part was sent to Tokyo Fish Market. It sold fresh at 11,000 yen per 20 kilograms (US$1.53/kilo), below market price of Hiroshima oysters. The Korean oysters harvested more than a week earlier (twice time allowed Hiroshima oysters destined for fresh consumption) were not best quality. They were used mostly for canning.

Origin of Oysters Troublesome

The 4 tons are negligible compared with Hiroshima's annual shucking of 32,000 tons. However, even if Korean oysters are frozen or canned, they are likely to be regarded as Hiroshima oysters because importer is Hiroshima's largest. (It handles nearly 20% of city's oyster sales.) Some oyster growers in Hiroshima tried to eliminate San-ei Suisan, but they failed because of company's long association with oyster growers. ('Minato Shimbun', Jan. 7, 1971.)

* * *

NICHIRO IS PURSE SEINING OFF WEST AFRICA

The Nichiro Company's purse-seine fleet caught 4,500 to 4,700 metric tons of tuna during July-Dec. 1970 in the eastern Atlantic off West Africa. This almost equals fleet's catch target of 4,800 tons. Although more skipjack and fewer yellowfin were taken than anticipated, the trip is expected to show a profit.

1970 Fleet Reorganization

Previously, Nichiro had lost money each year in purse seining off West Africa. In 1970, the fleet was reorganized and reduced from 6 pair-boat seiners and 2 motherships to 3 pair-boat seiners (9 vessels, including 3 skiffs) supported by 3,600-gross-ton mothership 'Hiroshima Maru'.

1971 Fleet Plans

The fleet fished until end of Jan. 1971. The mothership returned to Japan and will head back for West Africa in May. During that period, the seiners will be docked in an east Atlantic port. ('Minato Shimbun', Jan. 15, 1971.)

* * *

RECORD MOTHERSHIP-TYPE BOTTOMFISH CATCH IN BERING SEA IN 1970

The 1970 Bering Sea bottomfish catch by 10 Japanese mothership fleets reached record 1,184,000 metric tons. This surpassed by 38% previous high of 855,000 metric tons in 1969.

The large gain was attributed to increase in Alaska pollock landings--over 87% of catch. These landings have been increasing yearly since fleets began producing "surimi" (minced fish meat). ('Minato Shimbun', Jan. 22, 1971.)

JAPAN (Contd.):

Bottomfish Catch in Bering Sea

	1970	1969
	(Metric Tons)	
Alaska pollock	1,031,000	678,000
Flatfishes	89,000	106,000 1/
Cod	47,000	39,000
Herring	9,000	11,000
Sablefish	3,000	4,000
Pacific Ocean perch	2,000	11,000
Shrimp	2,000	4,000
Other species	1,000	2,000
Total	1,184,000	855,000 2/

1/Includes 96,800 tons of flounders and 9,5000 tons of arrow-toothed halibut.
2/The 1969 figures are rounded off. Catch was 854,600 tons.

* * *

TOKAI UNIVERSITY CULTURES TUNA SPECIES AND DOLPHIN

A 3-year study of the culture of tuna, skipjack, and dolphin is being conducted by Tokai University's College of Marine Science and Technology. The study is part of a Fisheries Agency program of marine culture of commercially important fish species begun in 1970.

The college has been rearing about 200 tuna, skipjack, and dolphin since Aug. 12 and reports that commercial culture of tuna and skipjack is promising.

Tuna, Skipjack, Dolphin

Tuna and skipjack, which normally swim straight, are extremely difficult to rear in a small tank. The rearing of one bluefin tuna for 2 months by Nagasaki Prefectural Fisheries Experimental Station is the longest.

On Aug. 12, 1970, at Mera Bay, the researchers began rearing bluefin tuna, skipjack, and dolphin in a seawater pen 10 meters long, 10 meters wide, and 1.5 meters deep--and in a tank 3.5 meters long, 3.5 meters wide, and 1.5 meters deep. Experiments also were carried out in a training pool 5 meters in diameter and 2.5 meters deep.

Several fish have died, but 200 (including dolphin) now can be seen swimming in groups. The experiment has passed its most difficult stage, the fish are feeding well, and survival should be good.

What's Ahead

Prof. Motoo Inoue, in charge of experiment, foresees no serious problems during winter.

The next objective will be to rear them to maturity and to spawn them artificially. Inoue also wants to fertilize skipjack eggs artificially aboard a vessel in waters around Bonin and Mariana Islands, and yellowfin and big-eyed around Truk Island. He plans to catch young tuna with lights and to rear them. He will collect tuna eggs with a net and hatch them in laboratory. ('Suisan Keizai')

* * *

UNDERWATER HABITAT NEARS COMPLETION

A nearly $1-million submarine habitat begun in a Kanagawa Prefecture shipyard in 1969 was scheduled to be completed in February 1971.

The Japanese Science and Technology Agency (STAA) is building the habitat, known as "Undersea Operation Base". It will be installed on seabed 30 meters deep off Ito, Shizuoka Prefecture. The habitat consists of a main 65-ton compartment with workshops and living-quarters, an elevator, and surface buoys. The compartment is cylindrical and measures 10.9 meters long and 6.5 meters high. It is designed to withstand pressures at a depth of 110 meters. Inside are a bedroom for four, a kitchen-dinette with hot running water, laboratories, and the central control office. STAA said it was designed to accommodate four persons comfortably for one month.

Experiment in Nov. 1971

Four aquanauts will occupy it in Nov. 1971. They will breathe artificial air--95% helium and 5% oxygen. Because helium extracts heat from human body, room temperature will have to be kept at 28° C. to 32° C. (82.4°-89.6° F.) with electric heater.

Another disadvantage is dietary. The aquanauts may only eat frozen food thawed in hot water. Flame is forbidden in the artificial air. Four-man teams will take turns living in the

JAPAN (Contd.):

craft for 5 days. They will photograph marine life, sample soil from seabed, and examine effects of high underwater pressures.

If first experiment is successful, the craft will be lowered to 60 meters for another experiment in 1972, and to 100 meters in 1973.

24 Being Trained

Twenty-four youths, including graduate students and employes of ocean-oriented companies, are undergoing intensive training.

STAA officials say Japan is 5 to 8 years behind France and the U.S. in this field. There, successful experiments with similar craft have been conducted in depths ranging from 130 to 186 meters. ('Japan Times', Jan. 1, 1971.)

* * *

PHASES OUT FISHING IN NEW ZEALAND WATERS

The 3-year Japan-New Zealand fishery agreement, concluded in October 1967, expired on Dec. 31, 1970. It had allowed the Japanese to fish within New Zealand's 12-mile fishery limit up to 6 miles from the coast. Japan was limited to 17 vessels, total tonnage 6,000 GRT, and had to furnish a list of vessels fishing in the area each month.

New Zealanders Want Fish

The Japanese are hoping to extend the agreement, but their extensive mothership operations and large catches, mostly sea bream, have been eye-openers to New Zealanders, who will try to catch the fish themselves. But their coastal vessels are small and not equipped for large, efficient fishing.

New Zealanders reported that Japanese violated agreement many times by coming closer than 6 miles and will now violate New Zealand's 12-mile fishery limits. (From 'Asahi Evening News', Jan. 1, 1971.)

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NMFS Comment: Japanese officials have been soft on companies that violated the agreement; penalties have been mostly administrative not financial. Japanese had hoped to form several joint ventures to exploit fishery resources within 12-mile limit. However, findings of 1969 survey team discourage this scheme. Nevertheless, Taiyo established joint venture with A.G. Wicelams Co. in Sept. 1967--capitalization US$368,000, 27.4% contributed by Taiyo ($100,800).

* * *

LARGE PURSE SEINER LAUNCHED

The 99-GRT purse seiner 'Nippon Maru', first Japanese-built seiner of its size, is scheduled for delivery to its owners, the Overseas Purse Seine Fishing Co., in early April 1971.

Its Vital Statistics

The vessel is modeled after U.S. tuna seiners. It will be equipped with U.S. power block and use four U.S. 65-hp., 45-knot speed boats. Main specifications are: overall length 59.05 meters (193.7 feet), width 11.8 meters (38.7 feet), depth 7.68 meters (25.2 feet), main engine 3,500 hp., speed 16 knots, crew 17. Total construction costs, including speed boats, will reach 620 million yen (US$1.72 million).

Hopes on New Seiner

The Japanese are pinning much hope on the Nippon Maru in their contest with U.S. seiners. It will be sent to eastern Pacific yellowfin and skipjack grounds around May 1971. Two-thirds of the operating costs will be subsidized by the government, which has designated it to explore for new fishing grounds. ('Minato Shimbun', Jan. 31, 1971.)

The seiner will have a brine-freezing unit (minimum temperature -0.4° F.). It will fish for 4 years without returning to Japan; crew replacements will be flown out periodically.

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NMFS Comment: The Overseas Purse Seine Fishing Co., established in June 1970, sent representatives in Sept. 1970 to San Diego, Calif., to hire a U.S. trawl master for its new purse seiner. In Oct. 1970, 7 U.S. tuna fishermen were hired to give technical advice and to help crew the vessel. The ship's master and the chief engineer, however, will be Japanese.

Since the vessel will not be ready until April 1971, after closure of regulatory yellowfin season, skipjack tuna will be fished instead.

TAIWAN

1970 FISH PRODUCTION INCREASED 9.3% OVER 1969

Taiwan's fish production in 1970 totalled 613,044 m.t., an increase of 9.3% over the 560,783 m.t. of 1969. The 1970 production of each fishery category compared with 1969 was:

	1970 (m.t.)	1969 (m.t.)	Increase m.t.	%
Total	613,044	560,783	52,261	9.3
Deep-sea	277,955	255,057	22,898	9.0
Inshore	234,704	221,646	13,058	5.9
Coastal	27,690	27,010	674	2.5
Fish culture	72,695	57,064	15,631	27.4

The production target set for 1971 is 665,000 m.t. with the following breakdown: Deep-sea fisheries, 329,000 m.t.; inshore fisheries, 241,000 m.t.; coastal fisheries, 25,000 m.t.; and fish culture, 70,000 m.t.

Fish Export

The export of fishery products in 1970 totalled US$66.7 million compared with US$44.7 million in 1969. Most of the fish exported are frozen tuna and marlin transshipped from overseas ports. Shrimp is the next important export item.

Artificial Propagation of Mullet

Continuing the experiment of the 1969-1970 season, the Tungkang Marine Laboratory succeeded in rearing the hatchlings of the grey mullet to stocking size. From a fish stripped on Dec. 21, 1970, 6,000 fingerlings survived and grew to 2.2 cm in length as of Jan. 31, 1971. It is expected that the Laboratory will be able to produce 20,000 to 25,000 mullet fingerlings this winter to a size suitable for stocking.

The Laboratory also succeeded in breeding for the first time a pond-reared mullet of about $3\frac{1}{2}$ years in age on January 17th. Several thousand hatchlings have survived and were in healthy condition at the time of this report, Feb. 5, 1970.

T. P. Chen
Chief, Fisheries Division
Joint Commission on Rural Reconstruction, Taiwan

* * *

PLANS TO BUILD TUNA LONGLINERS

The Taiwanese have scheduled construction of forty 250-GRT tuna longliners. Government approved, the vessels will be financed by a US$10 million loan from Asian Development Bank (70%), and private Taiwanese capital (30%).

Tuna-Mercury Problem

The tuna-mercury problem encountered in the U.S. in Dec. 1970 had generated arguments against building tuna vessels, but the Taiwan Fisheries Bureau decided to go ahead. The Bureau reportedly said its future efforts will be directed toward building large purse seiners. ('Katsuo-maguro Tsushin', Jan. 26, 1971.)

EUROPE

USSR

BUYS FISH-MEAL PLANTS FROM DENMARK

After years of negotiations in Moscow and Copenhagen, the Danish firm Atlas has secured a Soviet order for 20 million DKr. (US$2.66 million) to deliver 8 fish-meal plants for 2 factoryships. The combined daily production capacity of each vessel, 1,200 metric tons of raw fish, will yield about 400 tons of meal.

New-Type Vessels

The vessels are 2 new types built at a Soviet shipyard. They will be equipped too with freezing and filleting equipment.

Atlas previously had delivered smaller fish-meal plants for Soviet vessels. Several were built at Burmeister & Wain Shipyard in Copenhagen. (U.S. Embassy, Copenhagen.)

* * *

'FROST-PROOF' RESERVOIRS FOR LIVE CARP IN LITHUANIA

A reservoir for live fish has been built on the Neman River downstream from hydroelectric power station feeding Kaunas, Lithuania. The reservoir is filled with warmer water from power station and does not freeze over in winter.

Carp Available Longer Period

Already, 40 metric tons of carp raised in local hatcheries have been placed into the 400-ton-capacity reservoir. Kaunas stores will be supplied with live carp through March. In the past, live carp was marketed only during a short period in autumn. ('Pravda', Dec. 16, 1970.)

ICELAND

1970 CATCH WAS SLIGHTLY ABOVE 1969

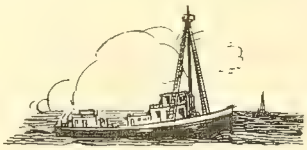
Iceland's 1970 fishery catch is estimated at 720,000 metric tons, compared to 689,400 in 1969. Herring continued poor: only 45,000 tons were landed. While this was a slight drop from 1969's 56,900 tons, it was only a fraction of the 461,500 tons caught in 1967.

The groundfish catch of 469,000 tons was up slightly from the 390,100 tons in 1969, but it was less than expected. Lobster, scallop, and shrimp catches reportedly rose.

Board Raises Prices

As 1971 began, the Iceland Fisheries Pricing Board raised the average landed price of fish by 25%--including 35% for haddock (in short supply) and 27% for cod. Retailers reacted with 15% increases.

Vessel owners and fishermen negotiated contracts for 1971 during the last days of 1970. By mid-January, unions had ratified most, but not all, agreements. Owners and officers still had not agreed. The officers went on strike as their vessels returned to port. (U.S. Embassy, Reykjavik, Jan. 13, 1971.)



DENMARK

REPORT ON GREENLAND'S COD FISHERIES

Greenland's 1970 catch of cod was about 17,000 metric tons (gutted weight), a 28% decline from 1969; and the latter was 44% below 1962 record. Poor catches may be expected for several years because there is no evidence of improvement in recruitment.

Most of the current fishery is based on the 1963-65 year-classes. The year-classes since then have been relatively small, so the cod stock is expected to be low until 1974. Hope lies with the 1965 year-class now entering the fishery.

Catch by All Nations

The cod catch by all nations fishing off West Greenland was 230,000 tons in 1969, the lowest since 1959. A decrease in effort since 1967 is one reason for the decline. Efforts were directed toward Labrador and the northeast Arctic, where conditions were somewhat more profitable.

In 1969 and 1970, an enormous ice field hampered fishing. Simultaneously, large amounts of cold polar water arrived. Temperatures at West Greenland fishing banks were unusually low.

Large Stern Trawlers Ordered

Most cod now are taken in inshore waters by small boats. Four large longliners fish on offshore banks, where foreign fleets have caught about 90% of annual total.

To remedy uncertainties of inshore fishing, and to ensure steadier fillet-plant operation, the Royal Greenland Trade Department (RGTD) contracted for large new stern trawlers. The first entered fishery in May 1969. Another, the 'Nuk', landed 1,618 metric tons of cod (gutted weight) during 1969, and about 2,700 tons in 1970.

Two larger stern-trawlers, nearing completion, will start fishing this summer. These vessels are 58 meters long, 11 meters wide, and have a hold capacity of about 550 cubic meters. The Nuk had only 280. They are equipped with double trawl rigs and reinforced hulls. The trawl winches will be located aft of bridge on boat deck. This is believed to be especially advantageous in waters heavy with drifting ice. Crew quarters include 24 one-man rooms.

Since the need was great to obtain offshore fishing capacity this year, a Norwegian trawler was chartered and it fished from Sukkertoppen.

The Danish Ministry for Greenland has contracted for two 700-gross-ton stern trawlers to be ready in 1972 and 1973. These will be 58.6 meters long and cost US$8.2 million each. In 1973, RGTD plans call for a 7-vessel trawler fleet.

U.S. Big Market

Sixty percent of catch now is used to produce frozen fillets and blocks. Practically the entire production is exported to the United States. (Reg. Fisheries Attaché, Copenhagen, Jan. 14.)

LATIN AMERICA

PERU

MINISTER OF FISHERIES REPORTS 1970 WAS GOOD YEAR

On the first anniversary of the Ministry of Fisheries, the Minister, General Javier Tantalean V., reported on the status of Peru's fishing industry.

Over 200 companies are fishing. These employ about 32,000 fishermen: 20,000 for anchoveta, 12,000 for other fishing.

As of Nov. 9, 1970, exports had generated $320 million of foreign exchange; the industry is paying $32 million in taxes to the government. Foreign-exchange earnings were about $100 million greater in 1970 than in 1969--and $50 million more than estimates for the sector contemplated in the National Plan for Economic Development. This paves way for improvements in industry efficiency and commercialization.

1970/71 Fish Catch

Regarding 1970/71 season catch, Tantalean said it would be reduced by about 500,000 metric tons on recommendations of Peruvian Marine Institute. Total fish catch permitted for 1970/71 season has been fixed at 10 million metric tons; catch was 10.6 million metric tons in period 1969/70. This measure had been adopted, he said, to assure normal growth and preservation of the species, and to assure jobs for fishermen and their families. The Minister regarded fish catch of nearly 4.5 million metric tons in second-half 1970 as "a very good semester."

Closed Season

The Minister stated that closed season for both fish and shrimp catch will be January and February of each year. It will be rigidly enforced.

His Ministry is thinking of planting trout and troutlike fish in lakes and rivers throughout Peru during 1971 to improve fish production for home consumption.

Fig. 1 - Peruvian "anchovetera" with hold and decks full of fish unloading at Chimbote.

Fig. 2 - A typical small purse-seiner of the anchoveta fleet waiting to unload.

He believes the industry is in good shape. It is improving steadily as a foreign-exchange earner.

New Law Awaited

In an earlier statement, the Minister had said that the new Fisheries Law would be published "before the end of the present year" (1970). All attention is centered on whether the new law will contain provisions creating "fishing communities" similar to the "industrial communities" recently decreed for the industries. If it does, and the betting is that it will, the question is what such a determination will mean in terms of new investments and orderly growth for this important sector of Peru's economy. (U.S. Embassy, Lima, Dec. 24, 1970.)

INDEX

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BACK COVER: A Korean woman in fish market at Inchon with string of squid. (FAO photo)

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DEPARTMENT
OF
COMMERCE
National
Oceanic and
Atmospheric
Administration

National
Marine
Fisheries
Service

U.S. DEPARTMENT OF COMMERCE
Maurice H. Stans, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. Robert M. White	Howard W. Pollock	John W. Townsend, Jr.
Administrator	Deputy Administrator	Associate Administrator

NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: Killer whales (foreground) pursuing sea lions (bow of ship). See account by Jim Branson on p. 39.

COMMERCIAL FISHERIES
Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Managing Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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CONTENTS

The NMFS research vessel 'Delaware II' sails from Woods Hole, Mass., to assess shellfish resources south of New England. See cruise report page 9.

INTERIOR & COMMERCE TO CELEBRATE 100 YEARS OF FISHERY CONSERVATION

Secretary of the Interior Rogers C.B. Morton has announced that his department and the Department of Commerce will sponsor a conference on "Fish in Our Lives" in Washington, D.C., in December 1971 to commemorate the 100th anniversary of Federal fishery conservation efforts.

The conference is expected to attract fishery scientists, economists, sport-fishing interests, and nutritionists. The conference will deal with many aspects of fishery resources, including the growing menace of pollution.

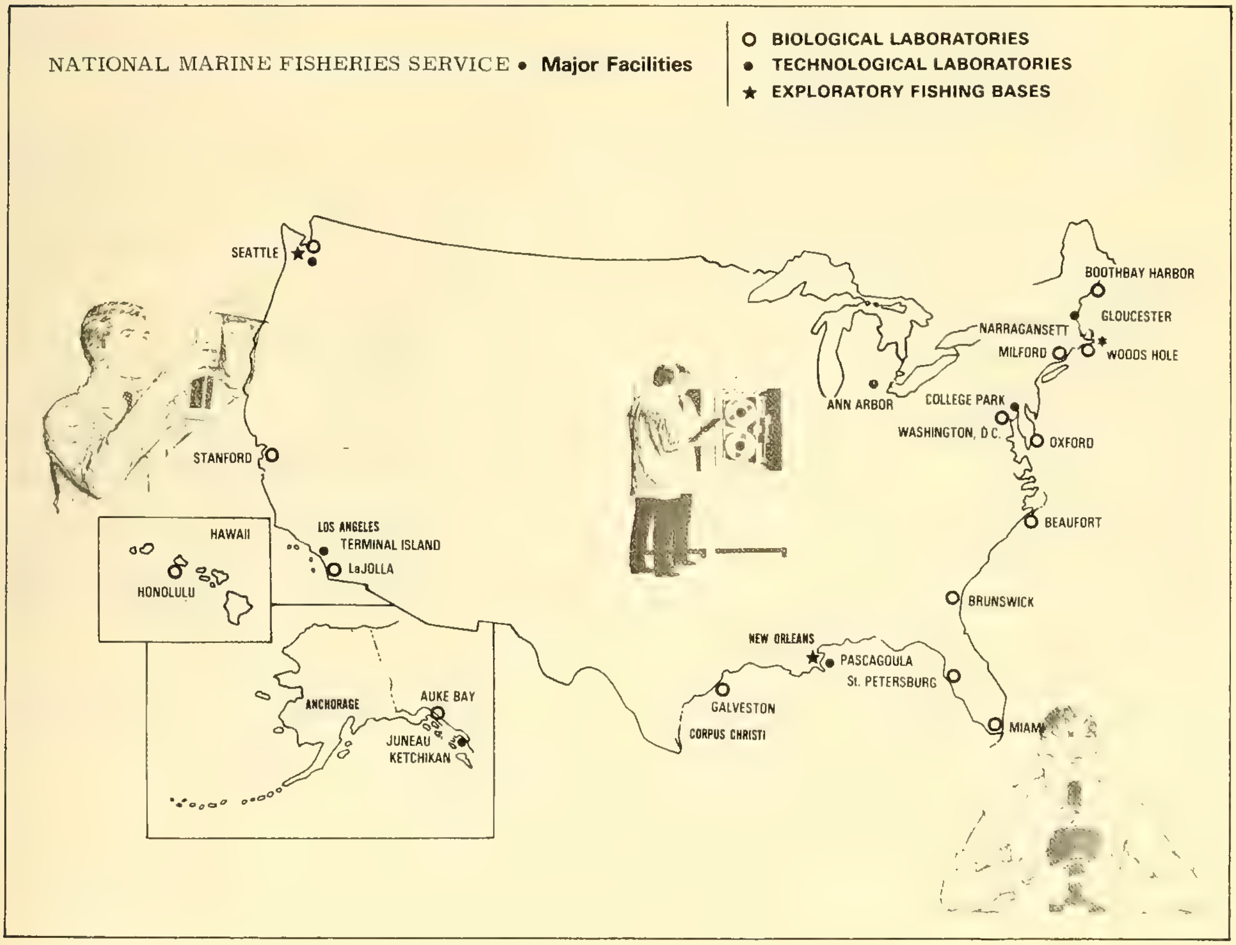
Secretary Morton said Federal fish hatcheries and laboratories will hold open house during the year.

Began in 1871

In 1871, Spencer Fullerton Baird was appointed first commissioner of fish and fisheries. President Grant signed an act "for the protection and preservation of the food fishes of the coasts of the United States." Since then, Federal fish conservation has been the responsibility of a succession of agencies--at present, Interior's Bureau of Sport Fisheries and Wildlife (BSFW) and Commerce's National Marine Fisheries Service (NMFS).

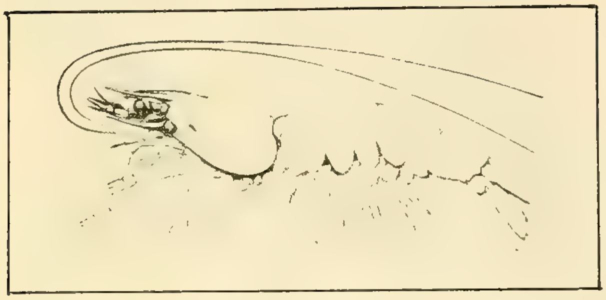
BSFW operates 100 national fish hatcheries and 16 fish-research laboratories.

NMFS has nearly 30 laboratories and exploratory fishing bases involved in fishery research.



BROWN SHRIMP LIVE LONGER THAN MANY BIOLOGISTS BELIEVE

It has been generally accepted among fishery biologists that the average life span of the more important penaeid shrimps is about 1 to $1\frac{1}{2}$ years. However, recent evidence suggests that they live considerably longer.



Past longevity estimates were based on size distribution studies, body proportion measurements, and marking experiments using tags and dyes. During 1969, personnel of the National Marine Fisheries Service Biological Laboratory at Galveston, Texas, tagged and released 6,514 brown shrimp, Penaeus azetecus, in 24 fathoms southwest of Freeport, Texas. These shrimp, sexually mature adults (average total length 169 mm), were at least 8 to 12 months old. They were marked with a cut-down version of the Petersen disc tag, the best mark available for large shrimp. Pins used to secure the discs were coated with an antibiotic mixture to retard infection.

Since release, 583 (8.9%) have been recaptured; several, males and females, are at least 20 to 27 months old. Recent returns indicate the probability of more recoveries and a further extension of the known life span of brown shrimp.

--K. N. Baxter

U.S. AND USSR STUDY SHRIMP IN GULF OF ALASKA

The abundance and distribution of northern shrimp over a large part of the Gulf of Alaska is being studied in a cooperative U.S.-USSR research project.

The project resulted from discussions between U.S. and Soviet scientists in Moscow, December 1970. Such meetings are provided for in U.S.-USSR agreements concerning North Pacific fisheries as opportunities to study the status of resources.

The Vessels & Areas

Three research vessels are participating: the Soviet 'Krill', the NMFS 'Oregon', and the 'Resolution' of the Alaska Department of Fish and Game.

The Krill is working exclusively outside the 12-mile U.S. fishery limit; the Resolution only within the 12-mile limit; and the Oregon on either side of the 12-mile limit.

Sampling stations extend from Portlock Bank along south coast of Kodiak Island and westward to Shumagin Islands.

Two NMFS scientists are aboard Krill to observe trawling operations.

EDA GRANTS FUNDS FOR HARBOR IMPROVEMENT IN SEWARD, ALASKA

The Economic Development Administration (EDA) of the U. S. Department of Commerce has approved a $288,000 grant and a $72,000 loan to stimulate growth of the fishing industry in Seward, Alaska.

The City of Seward will use the money to build a wharf to provide additional berths for commercial fishing boats. The wharf will be constructed between existing docks serving the fishing fleet.

City officials say the expansion will help increase fishermen incomes and enhance plans to put processing operations on year-round basis.

ALASKA'S SALMON FORECAST

Alaskan salmon harvests of slightly over 40 million fish of all species are projected for 1971 season, reports Melvin C. Seibel, Alaska's Commercial Fisheries Division. If this harvest is achieved, it would produce about 2.3 million cases of canned salmon--and 15-20 million pounds of fresh, frozen, and cured salmon products.

In 1970, about 66 million salmon were harvested. The lower projected harvest for 1971 reflects weakness in recent odd-year pink salmon runs to Southeastern Alaska and Kodiak, and an off-cycle year for Kvichak River system. The latter is the major contributor to Bristol Bay sockeye fishery.

1971 Forecasts

Preliminary 1971 forecasts indicate an especially weak predicted return of 4.3 million pink salmon to Southern Southeastern. This size could sustain little, if any, harvest; nearly the total return would be needed to meet escapement requirements.

Northern Southeastern has projected harvest of 5 million pink salmon. Prince William Sound has a brighter outlook: a total return of 6.2 million pinks, and harvest projection of 4.7 million. Seven million pink salmon will be available for harvest in Kodiak fishery if forecasted return of 8.3 million materializes. A predicted return of nearly 17 million sockeye to Bristol Bay fishery would yield harvest of nearly 10 million.

What Estimates Depend On

The Department of Fish and Game emphasizes that harvest estimates depend on 1971 total salmon returns being the size expected. Weaker returns may require more restriction of harvests to insure desired escapement goals. Larger-than-forecast returns may allow relaxation of regulations to insure maximum allowable harvest.

The forecasts result from extensive studies each year throughout state. Estimates of parent spawning populations and later abundances of young salmon gotten during past several years were analyzed for 1971 forecasts. In areas such as Prince William Sound, these techniques have been refined repeatedly. They now provide forecasts with sufficient accuracy for management and operational planning.

1970 Forecast

In 1970, the Department's first statewide salmon-harvest forecast (released in Nov. 1969) of 96 million proved too high; about 66 million salmon were harvested. Salmon returns considerably smaller than anticipated in 3 major Alaskan fisheries--Southcentral and Kodiak pink salmon, and Bristol Bay sockeye fisheries--accounted for roughly 90% of difference between projected and actual 1970 salmon harvest.

Total returns below forecast levels in these areas required additional restriction of harvest to insure achievement of adequate escapements. Widespread weaknesses in salmon runs throughout Alaska and British Columbia suggest possibility that below-average survival conditions existed in ocean-rearing areas.

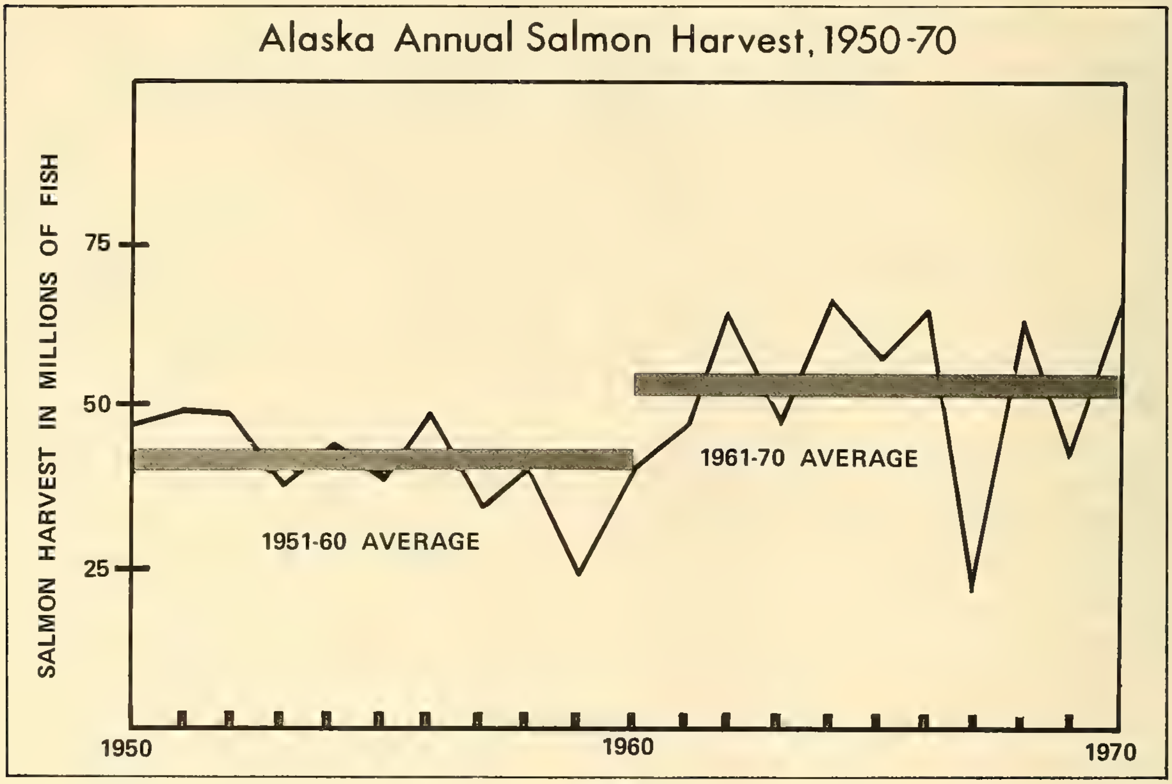
Although 1970 harvest was below forecast, the 66 million salmon produced 3.7 million

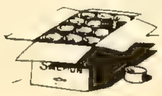
cases, and the largest harvest in more than 20 years. Major contributions included 10 million pink salmon from Southeastern, 12 million pinks from Kodiak, and 21 million sockeye from Bristol Bay.

State Optimistic

The Department is optimistic about the future of Alaska's salmon resources. This is not based on the size of a salmon harvest for any single year. Because salmon populations exhibit large natural fluctuations, it is necessary to base measures of population health on averages or trends. The graph below depicts annual commercial harvests of salmon in Alaska for 1951-70.

The two horizontal bars represent average annual harvest levels for the two 10-year periods--1951-60 and 1961-70. Average annual salmon harvests during the latter have exceeded by about 12 million fish the average of previous 10-year period. On a cumulative basis, this increase resulted in 120 million more salmon for Alaskan fisheries since 1961. If there are no natural catastrophes, or loss of salmon habitat from unwise development of other resources, Department biologists are confident that this higher level of production can be sustained and also increased. The Department emphasizes that achievement of maximum sustained harvest is primary goal of commercial fisheries management.





A Special Report on

FISH BLOCKS and STICKS and PORTIONS

Morris R. Bosin, Clemens B. Bribitzer,
Donald R. Whitaker
NMFS Division Current Economic Analysis

In 1970, supplies of blocks, sticks, and portions increased, but the rate of increase was not so great as in 1969. Imports of blocks were high in first-half 1970 but dropped sharply in second half as inventories were depleted in exporting countries.

The shortage of blocks, especially cod, caused prices for all blocks to rise; these reached record levels in December. As prices rose, U.S. inventories fell to 30.7 million pounds at the end of 1970.

Production of sticks and portions in 1970 increased 6% over 1969 but, in the fourth quarter, production was less than in 1969 period.

The higher prices of blocks forced a rise in prices of sticks and portions, which set records at the close of 1970. Concurrently, there was a decrease in disappearance of blocks, sticks, and portions in second-half 1970 compared to first half.

Two principal conditions will greatly influence the quantity of block imports and production and the sales of sticks and portions in 1971:

(1) the worldwide shortage of supplies of blocks, and

(2) the resultant high price levels.

GROUNDFISH

In 1970, supplies of groundfish fillets were 384 million pounds, 9% above 1969 and 18% above 1965-69 average. Landings of groundfish declined again in 1970--down 11% from 1969 to 92 million pounds (fillet weight). Imports continued to make greater inroads into U.S. markets. They increased 18% in 1970 to 245 million pounds and accounted for most of increase in supplies.

In the past 2 years, a discernible pattern of events has affected most groundfish species. In 1969, and especially 1970, prices in the economy became increasingly inflationary. Wholesale prices of groundfish fillets in the U.S. also rose, reflecting increasing costs of operation. High wholesale prices for fillets attracted heavier quantities of imported fillets--notably cod, flounders, and haddock. Imported products have been able to compete effectively with the domestic product because of lower production costs and because U.S. distributors considered imports a more stable source. An important reason for this stability was that supplies coming from several nations spread the risk of declining fisheries.

When a larger proportion of world fillet production was shipped to the U.S. in 1969 and 1970, a greater strain was placed on world

supplies. Greater fishing effort by exporting countries, along with rising costs, made these countries more dependent on high wholesale prices, such as those in the U.S.

Toward the end of 1970, wholesale prices began to level off as the economy cooled somewhat. The combination of scarcer supplies of some species (cod and haddock) and higher fillet prices, compared to other food items, accounted for a slowdown in consumption.

Although the demand for cod fillets has been bolstered by the burgeoning fish-and-chip outlets, scarce supplies and higher prices very possibly may cause buyers to resort to substitute species at lower prices. However, not all potential demand for cod fillets will be satisfied by substitutes, especially in institutional market.

In 1971, world supplies of cod fillets, and possibly pollock, may be diverted increasingly from the U.S. market. The United Kingdom and European Economic Community countries are likely prospects because of rising prices there.

The rise in wholesale prices of fillets in 1970 did not prevent consumption from reaching 333 million pounds, 9% above 1969. Cod-fillet consumption was constrained chiefly by supplies. Flounder and ocean-perch consumption may have been hurt in the latter part of 1970 by high prices.

Consumption of groundfish fillets is expected to be about 180 million pounds in first-half 1971; it was 181 million in first-half 1970. Flounder and ocean-perch consumption likely will rise, while consumption of cod, haddock, and pollock will fall.

World landings of cod are not expected to increase in 1971 and, possibly, may drop slightly in the next 2 years. A larger percentage of cod will be diverted to fillet production if--the potential demand for cod fillets in the U.S. generated by fish-and-chip franchises remains strong, and demand for sticks and portions levels off because of higher prices.

HALIBUT

Supplies of halibut decreased slightly in 1970 due to quota restrictions. Increased landings by U.S. vessels were offset by decreased imports.

Prices in 1970 were higher than in 1969, both wholesale and retail. Because of these higher prices, sales were a little low compared to previous years, and holdings at the end of 1970 were unusually high.

But a large increase in consumption in January 1971 ended fears of lower prices in 1971 because of decreased consumption and higher holdings in 1970. The outlook in 1971 is for firm prices and lower stocks.

WHITING

Supplies of whiting--headless and dressed--were 27 million pounds in 1970, 20% below 1969. Supplies have declined continuously for 5 years.

Consumption of whiting declined in 1970 following downward direction of available supplies. Consumption has also been down for

the last 2 years. With the prospect for low landings in 1970, processors paid high prices to fishermen to assure supply.

As a result of higher exvessel prices, wholesale prices rose. They began to attract substantial quantities of headless and dressed whiting from Argentina and South Africa. Prior to 1970, virtually all whiting were imported as blocks. Inventories of headless and dressed whiting began to build in summer 1970 as imports undersold domestic product.

To meet this competition, domestic processors began to lower wholesale prices, but exporters did likewise, and the price was still dropping in March 1971. Prospects in 1971 indicate that if wholesale prices continue to fall, imports will begin to shift back to blocks, especially because of the present U.S. shortage of blocks.

Consumption of headless and dressed whiting will probably continue to decline but, possibly, whiting in other forms--blocks and fillets--may take up some of slack.

SALMON

Salmon supplies were 2.2 million standard cases during first-half 1970, considerably lower than previous years. Canners and distributors made a concerted effort to reduce stocks during January through June to make room for anticipated record pack. Biologists had predicted a pack of 5.6 million standard cases, highest since 1941. The pack was larger than usual--3.9 million standard cases--but not a record. Salmon runs in Central and Southeastern Alaska fell below expectation.

Despite large pack, inventories were not excessive in second-half of 1970 and beginning of 1971. Prices for pink salmon were a little higher than 1969, reflecting relatively short stocks. Red salmon were plentiful, but prices remained firm.

The 1971 outlook is for a smaller salmon pack: 2.5 million standard cases, 36% below 1970, and 22% below most recent 5-year average. At beginning of 1971, inventories were not excessive. The industry is not unduly distressed about moving stocks in light of lower anticipated pack.

Prices should remain firm for red salmon and may even edge up for pinks. Consumption may rise slightly, primarily because of carryover from last year's large pack.

TUNA

Supplies of canned tuna increased substantially in 1970. Supplies were estimated at 505 million pounds, edible weight, 8% above 1969. U.S. tuna landings were a record 452 million pounds in 1970--also 8% above 1969. Imports totaled 313 million pounds, product weight, the 1969 level. Total production of canned tuna was 21.7 million standard cases in 1970--8.5% above 1969 pack.

Demand for canned tuna was strong during most of 1970; retail prices and per-capita consumption advanced. Exvessel and wholesale prices also increased sharply; albacore prices increased most rapidly.

In second-half 1970, and in early 1971, canned tuna was tested extensively for mercury. About 3.6% of U.S. domestic and imported

supplies was found to exceed the Food and Drug Administration's guideline of one-half part (.5) mercury per million parts of tuna. Tuna exceeding the guideline were withheld from sale or removed from market.

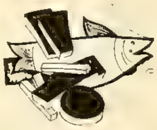
The outlook is for slightly higher prices and for recovering sales. It is possible that sales could be back to their long-run growth rate by midyear, if not sooner.

SARDINES

The domestic herring fishery continued to decline in 1970. Total supplies were 83 million pounds, 11% below 1969. U.S. landings decreased to 37 million pounds, about a third below 1969. The pack was below 20 million pounds for the first time in recent history of the fishery. Contributing to declining pack were low abundance, unpredictability of resource, and increasing use of imported sardines.

Imports of sardines increased slightly in 1970. But the category most competitive with U.S. pack--sardines in oil from Canada--more than doubled: 4.0 million pounds, compared with 1.9 million in 1969. Both wholesale and retail prices were up in 1970. Consumption was down, the decline mostly attributable to lower available supplies.

Prospects in 1971 are for a continued slight increase in imports, and a little lower consumption.



'DELAWARE II' ASSESSES SHELLFISH RESOURCES SOUTH OF NEW ENGLAND

The NMFS research vessel Delaware II defined and assessed resources along the continental slope south of New England from Dec. 18, 1970, through Feb. 26, 1971. The primary objectives of the 5-part cruise were:

1. To test and evaluate a system installed aboard the Delaware II for setting and hauling various pots in deep water.

2. Determine the species composition and distribution available to this fishing method during winter.

3. Gather biological information and samples of the catch; tag and release lobsters for migration studies; record and transmit hydrographic information.

4. Conduct test fishing with a variety of trapping devices (pots) along continental slope at 3 locations.

The scientists sampled at 3 primary locations off the Northeastern seaboard. Transects from about 100 to 600 fathoms were accomplished at Block, Hudson, and Baltimore Canyon (see map). All sampling was completed during January and February.

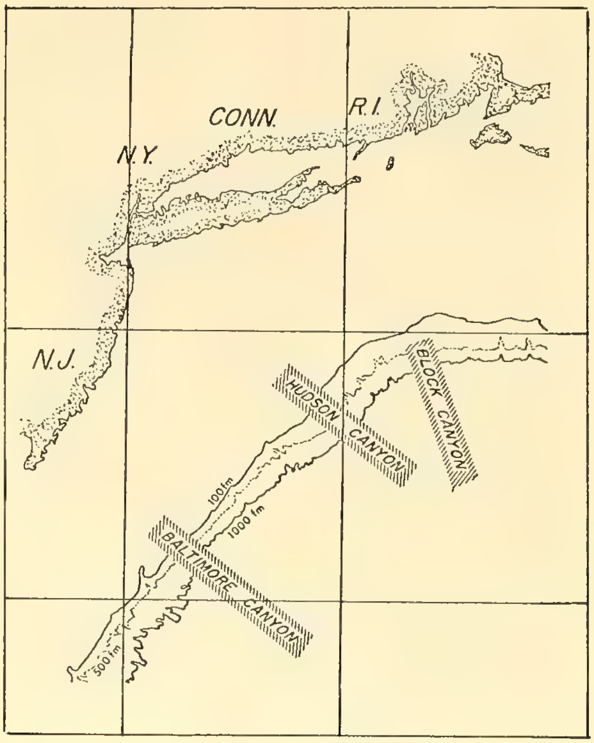


Fig. 1 - Areas of Operation.

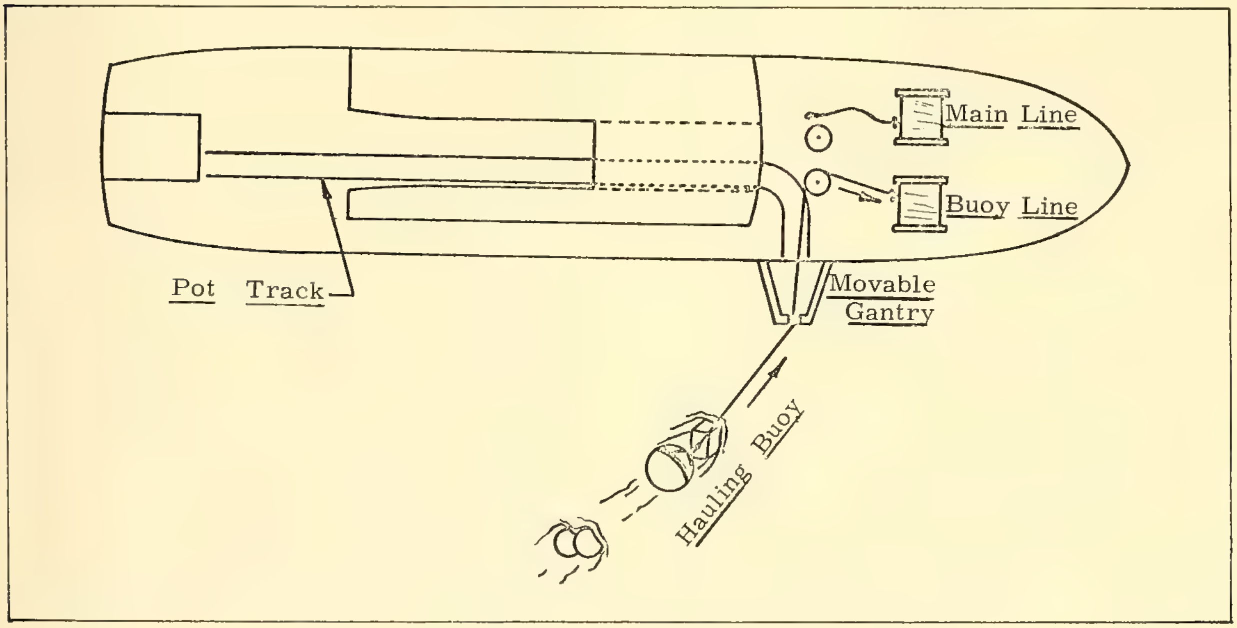


Fig. 2 - Delaware II's deck layout.

Three varieties of crustaceans comprised 92% of recorded catch of 20,103 pounds. Red crabs (Geryon quinquedens) were most abundant: 69% of total catch. In weight landed, lobster (Homarus americanus) was next most important species (13%); then Jonah crabs (Cancer borealis) 11%.

The remaining 7% were predominantly hakes (Urophycis sp.) and small amounts of other fishes and animals.

Gear and Handling System

To cover broadest spectrum, a variety of pot types were fished at most locations. These included steel, plastic-coated steel, and wooden lobster pots; cylindrical fish pots; wire-mesh shrimp pots, and west-coast king-crab pots. With exception of king-crab pots, all types were fished over a wide range of depths in sets of 10 to 50 pots. Strings of gear normally included one or more pots of each type.

Two king-crab pots, one standard and one with modified heads for taking fish, were fished individually. All pots were baited with herring and/or redfish frames.

Setting

The gear was organized into these components: (1) Buoys--a staff buoy with ball floats for one end of the gear, and only ball floats for other end. (2) Buoy line--$\frac{3}{4}$-inch polypropylene cored nylon braided rope. (3) Main line--$\frac{1}{2}$-inch galvanized wire rope. (4) Pots--lobster, shrimp, and fish traps.

The staff buoy was attached by 5 fathoms of polypropylene rope to a pair of inflatable ball floats. The buoy line, secured to this assembly, was divided into 50-fathom lengths to allow easy adjustment for many operational depths. The main wire was divided into 10-fathom lengths to permit changing number of pots fished on each set.

The sequence of operations during setting was: (1) Pots to be fished were baited and arranged in order in an open-ended skid-rack. (2) The vessel began steaming slowly along a predetermined track for setting the pots. (3) The buoy line was shackled to staff buoy and ball float assembly. (4) The staff buoy & ball float assembly was pushed out the stern ramp, followed by buoy line. (5) When enough buoy line had been set, the vessel was stopped. The buoy line was stopped off, disconnected, and the end of main wire was attached. (6) Then the main wire was set while steaming. A pot was attached to each 10-fathom length with a snap hook slipped over running line. The hook would snub against eye splice in each length of wire; the pot would be pulled overboard. (7) Again the vessel was stopped. The main wire was disconnected and more buoy line attached. (8) This buoy line was then set. (9) The vessel was stopped a third time, the buoy line disconnected, the buoy assembly attached and put overboard.

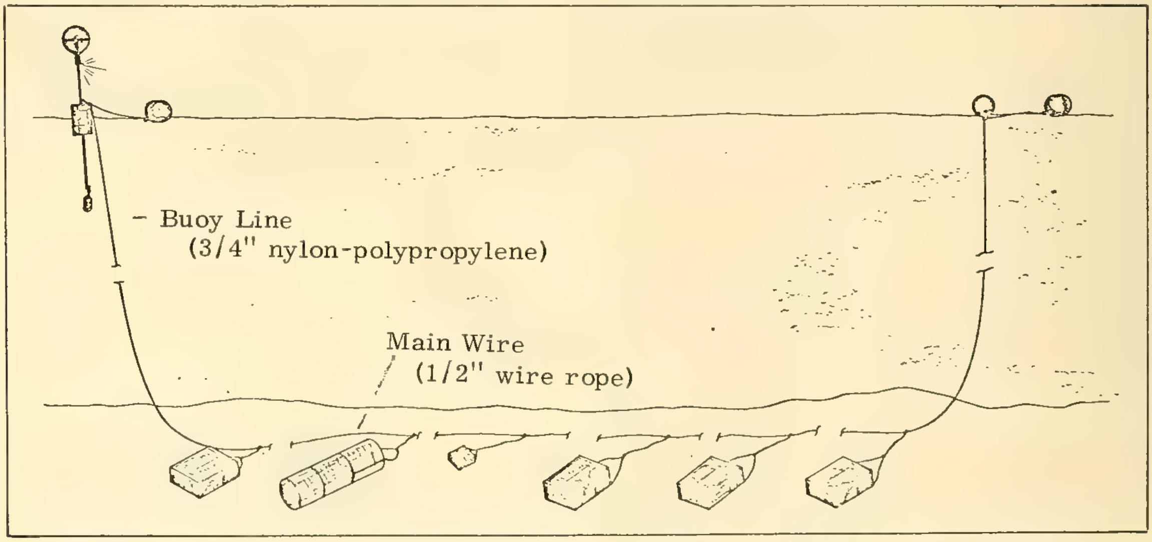


Fig. 3 - Schematic view showing arrangement of typical set. "Standard" sets usually consisted of a total of 20 pots, including 3 types lobster, shrimp, and fish pots.

Hauling

Hauling involved additional gear not used in setting. An opening in starboard bulwarks was used to bring pots aboard. A hydraulically powered movable gantry was mounted over opening. Two deck mounted fairlead blocks, one for buoy line and one for main line, provided leads to winch drums. A tensiometer was installed on one to provide an accurate gauge of load on buoy line. The rate of haul, therefore, could be adjusted to prevent excessive line tension.

The sequence of operations during haul back were: (1) The vessel approached buoy parallel with direction of set. (2) A grapnel was thrown over a floating line between staff buoy and ball floats. (3) A messenger line from starboard winch drum was passed through block at top of haulback gantry. (4) The buoy assembly was detached, hauled aboard, and carried aft for next set. (5) At same time, messenger line and buoy line were connected and hauling started. (6) When the buoy line was aboard, a messenger line from port winch drum was connected to main wire. (7) Buoy line was disconnected and hauling main wire with pots attached was started.

Fig. 5 - Stern area showing pots ready for launching off track. Note fairlead and buoy line.

Fig. 4 - Lobster pot coming aboard Delaware II. Note moveable gantry and track (at bottom).

(8) As hauling continued, the pots were brought to gantry hanging block. The gantry was brought inboard and pots were dropped on deck by action of gantry's arc of travel. (9) The pots were detached manually and skidded down racks for emptying, rebaiting, and storage in preparation for next set. (10) Then hauling was switched back to original winch drum for retrieval of buoy line at other end of string of gear.

Buoys

Two types of buoys were used: a lighted radar reflecting staff buoy, and inflatable ball floats.

The staff buoy was equipped with an aluminum radar reflector encased in a protective polyurethane foam sphere. Flotation was provided by a rectangular piece of styrofoam. Weight at bottom holds staff buoy upright.

The inflatable ball floats are about 20 inches in diameter. They are used with staff buoy to facilitate retrieval of gear (see Fig. 3).

Coverage and Results

Sixty-one sets were made ranging from 85 to 823 fathoms. Due to weather and other operational factors, the time each individual set was on bottom varied; the average soaking time was 21 hours.

The scientists sampled at three locations along continental shelf at Block, Hudson, and Baltimore Canyons. When possible, "standard sets" of 20 pot strings of gear were fished one or more times within each 100-fathom interval between 100 and 800 fathoms. Each set included lobster, shrimp, and fish pots. At some locations, standard sets were supplemented by sets using only lobster or king-crab pots.

Fig. 6 - Large lobster weighing about 20 pounds. Average weight of lobsters was over 3 pounds.

During cruise, 23,607 hours of pot-effort were completed. This was 1,000 individual pot-days of effort. Of this total, over 83% was by lobster pots; the remainder fish pots (8%), shrimp pots (7%), and king-crab pots (1%). Geographically, effort was divided equally among the 3 canyons.

The total catch was over 20,000 pounds, most of this crustaceans. Small amounts of fish also were caught.

Red Crabs

The red crab was 69% of total catch. This is particularly significant because the greatest concentrations of red crab were in relatively deep water, over 250 fathoms, and received somewhat less coverage than shoaler depths. In areas sampled, the most dense concentration of red crabs was at 400-fathom depth contour near Hudson Canyon. Here, lobster pots averaged 122 pounds of red crab per pot-day; a single king-crab pot caught 714 pounds in an 18-hour set.

Good concentrations of red crabs also were found at Block and Baltimore Canyon sampling sites. The red crabs averaged about 1.2 pounds each and were found from 166 to 823 fathoms. There were consistently high concentrations between 250 and 500 fathoms.

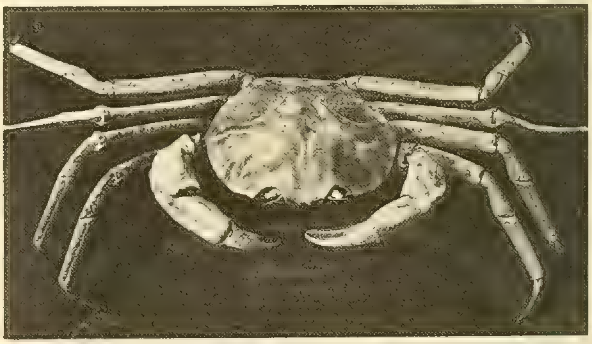


Fig. 7 - Red crab (Geryon quinquedens), the most abundant species caught. Occasionally reach over 2 lbs.
(Photos: W. F. Rathjen, NMFS, Woods Hole)

Table 1 - Fishing Effort by Canyon

		Pot Hours Fished					
AREA	No. Sets	Lobster	Shrimp	Fish	King Crab	Total	Percent
Block C.	18	5,975	661	785	96	7,517	31.8
Hudson C.	26	6,612	324	415	163	7,514	31.8
Baltimore C.	17	7,068	721	787	None	8,576	36.3
Totals	61	19,655	1,706	1,987	259	23,607	

Lobster

In weight, lobster catches were about 13% of total. They were caught at the three areas sampled from 85 to 300 fathoms. The best concentrations were between 150 and 200 fathoms at Baltimore and Hudson Canyons; there, lobster pots averaged about 6 pounds per pot during 24-hour periods.

Catch rates at shoaler and deeper depths were much less. Comparing the 3 areas sampled, the Baltimore Canyon provided the best catches. More than 800 lobsters averaging over 3 pounds were taken during cruise; of these, 326 were tagged and released for migration studies, the remainder preserved for research on stock identity.

Jonah Crabs

Jonah Crabs, which are similar to inshore rock crabs, were surprisingly abundant in observed catches. They were most plentiful in sets at less than 150 fathoms but were caught down to over 200 fathoms.

The best indications accounted for average catches of about 8 pounds per pot-day from lobster pots.

The observed depth ranges for the 3 predominant species of crustacea were:

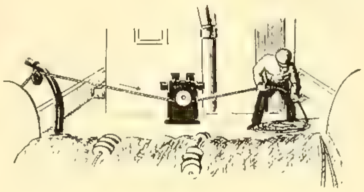
Table 2 - Depth Range of Crustacea

	Red Crabs		Lobsters		Jonah Crabs		Depth Fished	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
	Fathoms							
Block C.	175	654	85	273	85	210	85	785
Hudson C.	185	823	151	300	98	212	98	823
Baltimore C.	166	583	89	293	89	200	89	583
Entire Cruise	166	823	85	300	85	212	85	823

Fish

Catches of fish with the gear used were uniformly light. Red and white hake (Urophycis sp.) were the most common species in depths less than 500 fathoms. Beyond 500 fathoms, frequent catches of deep-water sharks and blue hake (Antimora rostrata) were made.

For more information, contact Keith A. Smith, Base Director, NMFS, EF&GRB, Woods Hole, Massachusetts 02543.



VIMS STUDIES HERRING SPAWNING SITES & NURSERIES

Scientists of the Virginia Institute of Marine Science determined recently which areas of 4 major river systems serve as spawning and nursery grounds for river herring and shad. The largest is the Potomac River with 45,000 acres of mainstream and 16,000 acres in 40 creeks from both Virginia and Maryland.

The James River system ranks second with 41,000 total acres; 8,300 of these make up 104 major primary and secondary streams.

The Rappahannock River is third with 16,000 acres, including 1,860 in 56 tributaries.

The York-Pamunkey-Mattaponi river system is fourth with 11,000 acres, including 900 acres in 38 streams. Only the two major branches of the York River system serve as nurseries because the York proper is too salty.

How They Sampled

Sampling was done monthly at 5-mile intervals from mouth of each river to fall line to locate nursery areas. A 4-man field crew used gill nets, seines, and fyke nets to capture adult fish. It used plankton nets to locate the eggs and newly hatched larvae. Extensive collections of juveniles were made with surface and midwater Cobb trawls. The crew worked from onset of spawning season in the spring until juveniles left in fall; it sampled a single river system each year.

Determining Spawning Areas

If ripe adults were caught, the site was assumed to serve as spawning area. The same assumption was made where eggs or larvae were taken in plankton nets. At least two visits, and frequently more, were needed to confirm whether a tributary or site in mainstream served as spawning area.

River herring and shad spawning areas extend upstream from point where fresh and salt water meet. The study indicates that most river herring spawn in the freshwater reaches of tributaries and, to a lesser extent, in tidal freshwater portion of mainstream. Above the zone in each river where fresh water first meets salt water, nearly all streams could be listed as "probable" or "confirmed" spawning sites. However, extensive industrial and domestic pollution in James and Potomac rivers has made some spawning waters unsuitable.

American & Hickory Shad

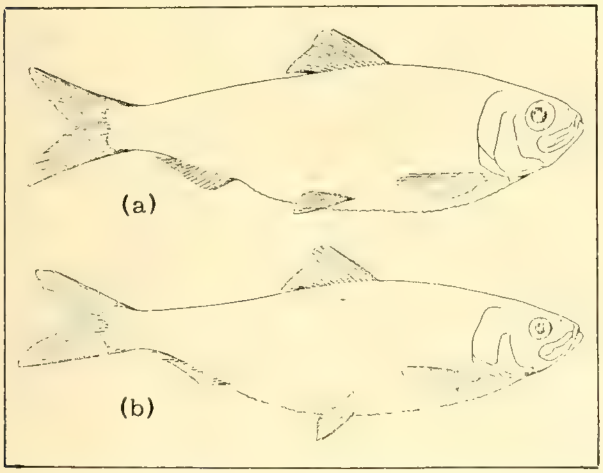
American shad prefer spawning on shallow-water flats of mainstream's tidal freshwater section. Most running-ripe spawners were captured on this area of the river. Shad also apparently spawn in tributary streams because shad larvae and young juveniles were found in upper reaches of tributaries shortly after spawning period.

Hickory shad also were found in running-ripe and spent condition in tributary streams and mainstream. These shad appear to run as far up mainstream as possible to spawn below first insurmountable barrier they meet. Hickory shad in spawning condition were taken below dam on Rappahannock River at Fredericksburg, at Walkers Dam on Chickahominy River, and below first dam at Richmond on

James River. Spawning hickory shad and river herring were captured in several tributary streams of these rivers.

Alewife & Shads

Alewife, hickory shad, and American shad enter Chesapeake Bay about same time in early spring. Blueback herring come later. Alewives have been reported in York-Pamunkey-Mattaponi river system in December and January. But earliest capture of alewives during VIMS study was in early February in James River system; surface-water temperature was 41°F. Alewives were found in spawning condition in tributary streams until mid-May. The height of spawning occurred during latter part of April, when surface-water temperatures ranged from 61° to 73° F.



Fishermen recognize alewife (a) and blueback (b) as two distinct kinds of river herring, but use several different names for them. Alewife is the deep bodied, big-eyed, greenbacked fish that runs early; blueback is the slender, small eyed, bluebacked fish that runs later.

Hickory Shad

The VIMS crews recorded earliest capture of hickory shad in York River system in late March; surface-water temperature was 50° F. These fish were found on spawning grounds with partially spent gonads until late May, when surface-water temperature was 73° F. Not enough were taken to determine peak spawning period.

American Shad & Blueback Herring

American shad enter Chesapeake Bay in March; height of spawning migration is in April. The earliest capture of ripe shad was in late March in Pamunkey River, when surface-water temperature was 50° F. Shad were found in spawning areas until late May, when water temperature was 67° F.

Blueback herring usually do not appear in the rivers until April; they remain until late May and early June. Most blueback spawning occurs in May when water temperature ranges from 64° F. to 75° F.

Males More Numerous

In all 4 species, the males generally are more numerous than females throughout spawning season; they also appear in the rivers earlier and stay later.

Starting in 1953, and continuing for 4 years, VIMS scientists investigated the effect of water temperatures on shad catches. They reported that almost no shad were caught below a water temperature of 40° F. Between 40° and 45° F, a few were caught. Largest catches were made in 45° to 59° F. At higher water temperatures, catches taper off but, even at 70° to 74° F, more shad were caught than at 39° F or less.

L.I. SHELLFISH THRIVE IN WEST INDIES EXPERIMENT

Oysters and clams shipped from Long Island Sound are being raised in St. Croix in the subtropical Virgin Islands in a bold effort to make use of what some have called the world's most important resource--the deep, cold, nutrient-rich water found in some parts of the world oceans. This was reported by Walter Sullivan in The New York Times on March 28.

The shellfish arrived in December 1970. Since then, their growth rate has been "absolutely fantastic," according to Dr. Arthur Chu, City University of New York, who is "mothering" the first crop.

I. Aquaculture

A larger plan, of which the shellfish experiment is one part, seeks to: explore the oceans' cold, deep layers for large-scale food production by "aquaculture"; generate power without pollution; extract moisture from trade winds to supply arid islands.

Antarctic Bottom Water

The Antarctic bottom water is the raw material for the plan. It originates in Antarctica's ice-clogged seas. It sinks beneath warmer waters of Atlantic, Pacific, and Indian Oceans. It inches northward until it crosses into Northern Hemisphere.

On its long voyage, the water gathers phosphates and nitrates from decayed marine life. It becomes remarkably fertile. And, where it surfaces--off Peru and West Africa, for example--oceanic life blooms.

Trying To Top Nature

The Virgin Islands experiment aims to stimulate and increase the upwelling phenomenon to propagate shellfish. The "longer-term prospect" is for use of the water's low temperature as a source of power and fresh water.

Three-quarters of the world's ocean water is colder than 50° F, state R. D. Gerard and Dr. A. O. Roels, Columbia University's Lamont-Doherty Geological Observatory. Much of it is just a few degrees above freezing. Because of its potential uses, they add, "it is obvious" that such waters are the planet's "most abundant resource."

St. Croix Experiment

A pipe has been laid from St. Croix's shore down to about 2,500 feet a mile off shore. Cold, nutrient-rich water is pumped into pools on shore. Cultures of one species of diatom, a microscopic form of algae, are put into the pools. The diatoms multiply until the water turns brown. Then they are passed through tanks with trays of oysters and clams.

The deep water is 50 times richer in phosphates and nitrates than surface water. The diatoms thrive--and so do the shellfish that eat them.

When the seed oysters and clams arrived in Dec. 1970, they were barely visible. They have been growing so fast that the scientists are looking forward to a summer feast.

In northern waters, oysters need 4 or 5 years to mature because they hibernate in winter and their diet is less rich.

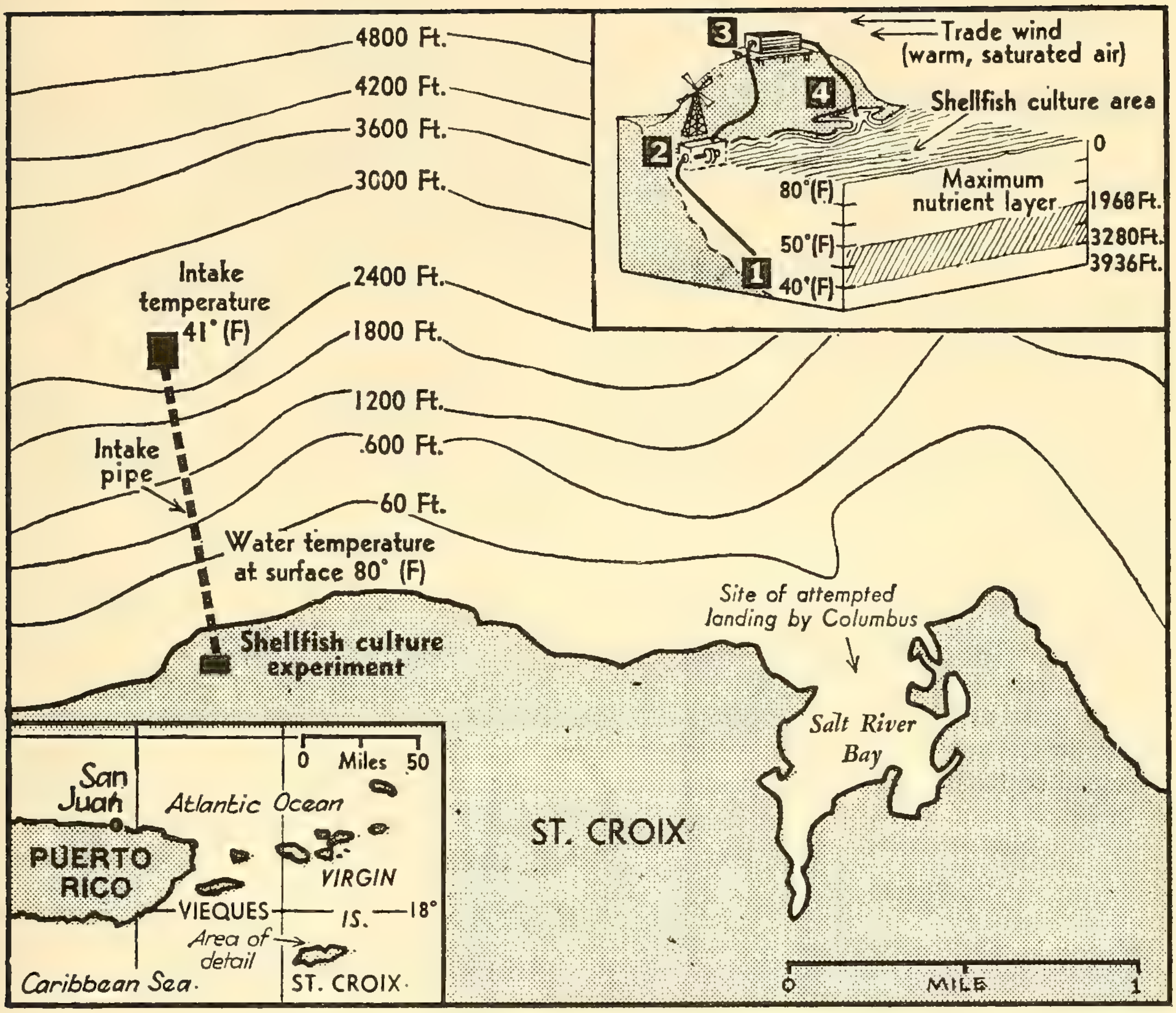
II. Power Plants

Intensive production of marine life could be a byproduct of the planned power plants, the Columbia scientists say. The principle underlying such plants was demonstrated by French engineers in a Cuban plant in 1930, and in Africa's Ivory Coast in 1950.

The success of steam plants depends partly on the efficiency of their cooling systems. A steam-driven destroyer moves faster in cold waters than in the tropics. The reason is that turbines are turned by a flow of steam. The intensity of the flow is determined by the difference in pressure between start and finish of heating cycle. The cooler the water at start of cycle, the greater the resulting pressure.

The St. Croix system would be special. By using Antarctic bottom water, it would operate at a very low-starting pressure--and, as a result, at a very low temperature.

Air pressure on a mountain is lower than at sea level, so water there boils more readily. If pressure is low enough, water will boil at temperature of tropical sea water--about 80° F.



Cold, nutrient-rich water is pumped from ocean depths off St. Croix as a means to mass produce sea food, as depicted above. Inset diagram, upper right, shows related plan for extracting fresh water from the moist trade winds. Cold water, drawn from deep, nutrient layer (1) by windmill pump (2) is used in cooling condensers (3) that collect water from damp air. The oceanic cooling water is then fed into lagoon (4) where marine life is cultivated. Columbia University is conducting the experiments.

(The New York Times, March 26, 1971)

In the proposed St. Croix power plants, a temperature and pressure difference sufficient to drive turbines would be created by using the heat in warm surface waters. The cooling agent would be bottom water at about 50^{o}.

III. Producing Fresh Water

To produce fresh water, the scientists would pass bottom water through hill-top condensers exposed to warm, moisture-laden trade winds. As wind strikes cold surfaces of the system, its moisture would condense--producing a steady trickle of fresh water.

A scheme like this was proposed by Mr. Gerard and Dr. J. Lamar Worzel of Lamont-Doherty Observatory. They noted that St. Croix was ideal for the experiment: it needed water and trade winds swept it continually.

Generally, the West Indies bar the flow of Antarctic bottom water into Caribbean. But there is a deep passage between Virgin Islands and Anguilla. This allows entrance of the water into a basin close to St. Croix's north shore.

Condensing fresh water from trade winds has an advantage over desalination plants. The latter extracting fresh water from the sea dump a highly saline residue. This endangers sea life.

In Gerard-Worzel plan, power to pump up deep water would be generated by windmills. The operation would be free of pollutants.

At present, the water drawn from depths off St. Croix pass through a pipe only $3\frac{1}{2}$" in diameter. When it reaches surface, it has been warmed considerably by sea's upper layers. If deep water is used as coolant, it will have to be pumped up quickly through a larger pipe.

Excelling Nature

The natural upwelling off Peru, which is responsible for rich fisheries, does not bring up the very deep water richest in nutrients, according to Gerard. The St. Croix experiment, reaching deeper into the sea, is trying to improve on nature.

Gerard and Roels have identified areas throughout the world suitable for deep-water exploitation. There, the surface waters are warm, and the deep, cold water is within 20 miles of shore. In a plan for large-scale aquaculture, they would instal conduits connecting coastal lagoons to deep water. Nutrient-rich water would be forced through these pipes into the lagoons. Pumping would not be needed.

In St. Croix, in pools enriched with deep water, the abundance of one-celled organisms reaches 10,000 times the level in adjoining sea. The organisms being grown are Cyclotella Nana, a diatom used as food in oyster hatcheries. The scientists are not sure it is suitable food for adult shellfish but, so far, it has been effective.

This may be first time individual species have been tested as food for maturing shellfish.

Culturing Diatoms

Each culture of diatoms is grown in succession of containers, each larger than the preceding one. In 8 days, one dropper full of diatoms proliferates enough to make a 12,000-gallon pool dirty brown.

The scientists are trying to learn enough about shellfish culture to assess its economic potential for many locations similar to St. Croix.

TANNER CRAB TAGGED SUCCESSFULLY FOR FIRST TIME

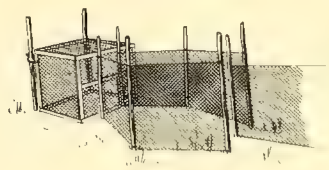
Tanner Crab
(Chionoecetes tanneri)

A small-scale tagging study by NMFS Auke Bay (Alaska) Biological Laboratory has developed a method for tagging tanner crab (Chionoecetes sp.) with a tag that will be retained through ecdysis (molting). John Karinen reports that of 9 male C. bairdi tagged with Floy anchor tags in the body musculature proximal to the third walking leg, 30% molted successfully and retained the tag; molting success of the controls was 90%. The biologists believe that molting success of tagged crab can be improved by modifying the tag and the insertion method.

Tanner May Come Home To Molt

The tagging program also has shown that tanner crab may return to a "home" area to molt and mate each year. SCUBA divers recently recovered a tagged male tanner crab in 30 feet of water at the Laboratory dock. It was one of 10 tagged in March 1970 and released at the same location. Tanner crab gather here each year to molt or mate and then return to deep water.

More tagging of tanner crab is underway to learn more about local movements and behavior.



ENVIRONMENTAL DATA BUOYS WILL BE TESTED IN GULF OF MEXICO

NOAA's National Data Buoy Project Office has selected General Dynamics to build several ocean platform systems. Each unit will have a buoy hull, moorings, power system, data-processing and communications systems.

These buoys, designed for oceanographic and meteorologic work, will be deployed in the Gulf of Mexico.

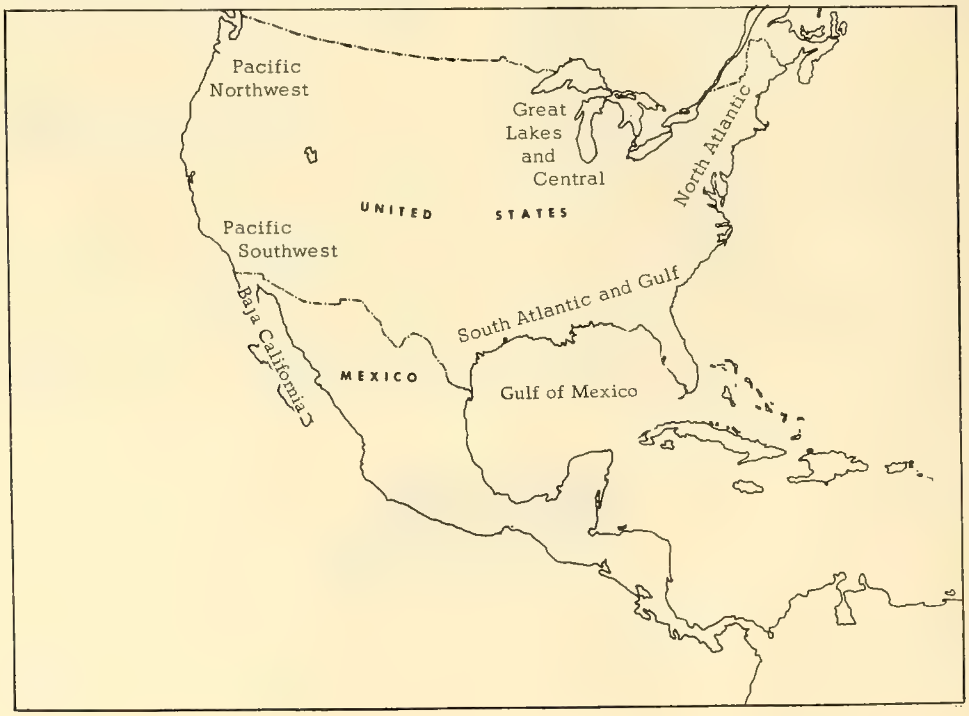
The General Dynamics-designed buoy has a discus-shaped hull and can withstand hurricanes with 150-knot winds, 60-foot waves, and 10-knot currents. Each buoy weighs about 100 tons when on station; it is capable of carrying over 100 sensors. These sensors will measure and report ocean and atmospheric conditions.

Long Needed

The buoys will fill the data gap in maritime areas. Inhabited regions are observed fairly well. International efforts currently seek to provide better coverage over land and oceans. "Measurements of the oceans are available from satellites, ships, and aircraft of opportunity, a few ocean station vessels, and occasional oceanographic ships sampling the environment. But more detailed information is needed on environmental conditions over vast marine areas."

Network of Buoys

A network of automatic buoys is needed throughout the oceans. It would measure and report environmental conditions in the oceans, coastal waters, bays, estuaries, and Great Lakes. It would provide data needed to predict weather, sea state, fish migration, monitor pollution, and also for marine transportation and other ocean-oriented industries. The World Weather Watch and the Integrated Global Ocean Station System programs may have someday a network of marine buoys and automatic land stations.



WARNINGS OF BAD WEATHER STRENGTHENED BY NEW DEVICE

Warnings of emergency weather from 12 radio weather stations along the U.S. Atlantic and Gulf coasts are being heightened by a special device called "tone-alert," which is being installed by NOAA's Weather Service on its UHF-FM stations.

The device transmits a signal that automatically increases the volume on special receivers within 40 to 50 miles of the station. Receivers without the tone-alert receive and broadcast a distinct 3-to-5-second tone just before the station operator transmits the emergency weather message.

When Device Is Used

The device is used immediately before special warnings of severe weather: tornadoes, hurricanes, winter storms, high winds, severe thunderstorms. These warnings are sent to hospitals, schools, civil disaster agencies, newspapers, TV and radio stations--and to those with radio receivers containing "weather band" at 162.550 or 163.275 megacycles.

U.S. Network Planned

In time, each UHF-FM weather radio stations of the Weather Service's nationwide network will have the alert device. The stations are part of NOAA's Natural Disaster Warning System.

The 24-hour-a-day stations transmit continuous weather forecasts and observations to farmers, sportsmen, boaters, and others needing reliable information. The regular flow of weather information is interrupted by hazardous-weather warnings.

Cost of Receivers

Equipment to receive the tone-alert is priced from about $150 upward. Receivers without tone-alert feature that can pick up Weather Service UHF transmissions start near $20.

The reception of transmissions, especially when low-cost receivers are used, depends on location and sensitivity.

MEXICO AND U.S. SET UP WEATHER STATION

Mexico and the U.S. have established a jointly funded weather station on Mexico's Guadalupe Island off Lower California. It is expected to improve warnings of storms threatening both countries.

The station makes upper-air observations to fill a need for atmospheric data from an ocean area that generates severe weather.

Upper-Air Reports

The upper-air reports made at Guadalupe Island are transmitted to the National Meteorological Center in Suitland, Md., by Mexican personnel who make observations twice a day. The reports are expected to offer valuable clues to the high-level steering currents that propel moist air inland from the Pacific and the Gulf of Mexico. ('Commerce Today', Mar. 8.)

ELECTRICAL SYSTEM WILL HELP DETECT MARINE POLLUTION

A system that will aid in detecting and controlling marine pollution has been devised and tested successfully by Texas A & M Sea Grant oceanographers. It is an electrical logging system that measures relatively quickly and cheaply the upper soft seabottom sediments. NOAA's National Sea Grant Program is supporting continued development and adaptation to computer techniques.

In-Place Gravity Probe

A main feature of the electrical system is an in-place gravity probe with electrodes in the nose. This is dropped into the soft bottom sediments. As it is withdrawn, it measures the electrical resistances of the sediments.

The oceanographers also have developed a device for obtaining the same measurements from cores. Also, they are showing how the electrical properties measured by either technique are related to some "chemical, physical, sedimentological, and engineering properties of the sediments."

Pollution detection is one of NOAA's responsibilities in monitoring the marine environment. Detection is vital to adequate pollution control. Bottom sediments are affected directly by changes in the kinds of particulate matter in the sea. Electrical logging techniques can record these changes.

Information obtained through logging also can benefit ocean engineering, mining, pipeline surveys, and basic research into bottom sediments.

System's Advantages

The oceanographers state that on-site measurement of electrical resistivities of sediments is a relatively quick and inexpensive way to determine some properties. Before, these could be measured only on shipboard, or in the lab, through subbottom samples gotten by the more painstaking technique of coring. Electrical logs will supplement, not replace, coring and reduce number of cores needed.

1969-70 Tests

Tests with probes 12 to 25 feet long were made in 1969 and 1970 south of Galveston, Texas, in northern terminal of Alaminos Canyon. In one series, electrical profiles were obtained in about 90 minutes of recording on the sea floor. Recovery of 30 cores from these stations would have taken about two weeks; analysis of their porosity and density would have taken months more.

Present Work

The oceanographers are building a new in-place device. With it, measurements will be made while probe is at the bottom. The device will end irregularities in pull-out caused by movement of the ship--and so increase accuracy appreciably.

NAVY SCIENTISTS DIVE AND WORK UNDER ARCTIC ICE COVER

Four oceanographers of the U.S. Naval Oceanographic Office (NOO) recently dived and worked under the Arctic ice mass less than 500 miles from the North Pole. NOO says the dives may be "the first extensive day-to-day operation ever conducted this far north."

The dives were made during a 10-day period in the 24-hour darkness of the Arctic night through a hole cut in 15 feet of sea ice adjacent to Fletcher's Ice Island. This is a floating 28-square-mile glacier. Since 1952, it has served as the site of an Arctic research laboratory for U.S.

The waters underlying the ice ranged in thickness from 15 to 60 feet. They were a constant 28.9 degrees Fahrenheit. Outside temperatures ranged from 20 to 39 degrees below zero. The first dive lasted 25 minutes; the longest was one hour, 55 minutes. The scientists reported that cold hands "were the principal factor limiting dive duration."

Their Purpose

The scientists were working to establish techniques for making scientific observations, especially measuring and profiling the underside of the ice cover. They photographed the ice with still and motion-picture cameras. They profiled a part of the underwater ice mass by direct measurement with tapes, measuring rods, and a recording slate.

"We were particularly interested in measuring and recording on film the juncture of Fletcher's Island with the adjacent sea ice," they said.

Value of Work

Oceanographers-divers can only provide information on a small part of undersea ice at any one time, NOO states, as opposed to wide-ranging surface techniques, such as aerial photography. But divers' data will be useful in relating "the bottom side with the top. If we know this general relationship, we can then infer what the bottom side looks like from our surface observations." A complete picture of ice structure will help NOO oceanographers predict movement of sea ice for the benefit of shipping in the Arctic and the Antarctic.

NOO's oceanographers provided much initial data that helped to insure a safe voyage for the 'Manhattan'. The world's largest oil tanker-icebreaker successfully navigated the icebound Northwest Passage in fall 1969.

OCEANOGRAPHERS HUNT EARTH'S OLDEST CRUST IN SOUTH PACIFIC

NOAA oceanographers aboard the 'Surveyor' are making a 6800-mile trip in April-May from American Samoa to South America seeking what may be the oldest part of the earth's crust in this area.

The Seattle-based vessel, operated by NOAA's National Ocean Survey, conducted a hydrographic survey of the approaches to Pago Pago Harbor in American Samoa before beginning the $3\frac{1}{2}$-week oceanographic expedition.

A Giant Chasm

Barrett H. Erickson, the project's chief scientist, said: "Although the undersea structural features in this part of the South Pacific are now poorly known, it seems that the oldest oceanic crust in this area may lie just east of the southern Tonga Trench." This great chasm in the seabed descends more than 6 miles below the sea surface; it extends south of the Samoan Islands toward New Zealand.

Erickson added: "A study of the geophysical characteristics of the oceanic crust between the Tonga Trench and the East Pacific Rise should provide evidence on the age and history of the oceanic crust in this area." The East Pacific Rise is a mile-high underwater mountain range lying in water almost 2 miles deep It parallels the northwest coast of South America.

The Surveyor expedition is part of NOAA's long-range program to investigate the sea bottom and to illumine the earth's history.

RECREATIONAL BOATING IS EXPANDING RAPIDLY

In 1970, recreational boating in the U.S. involved an estimated 44,070,000 persons who spent about $3,440,000,000. So reports the National Association of Engine and Boat Manufacturers.

The pastime has grown greatly. The industry estimates there were 8,814,000 recreational boats in the U.S. in 1970; 4,864,074 were registered by states and the Coast Guard. The boats ranged from plush sailing craft and sleek motor jobs to rowboats, prams, and dinghies.

Housing Them

The boatmen were from 5,900 marinas, boatyards, and yacht clubs. They hauled their craft to the water aboard 3,700,000 homemade and factory-produced boat trailers.

Industry's Growth

There were an estimated 3,510,000 recreational boats in 1950; in 1970, 8,814,000. Total expenditure jumped from $680,000,000 to nearly $3.5 billion.

Outboard Motors

An estimated 7,215,000 outboard motors were being used in 1970.

The skilled worker is the heaviest buyer of outboard motors: 24.5% of them. The professional was second with 17.6%. Clerical and sales people were third with 17.2%. Only 2% of factory workers bought outboard motors during the year.

The New York City area led in outboard motor use with 316,000. The average length of motor boats purchased in one 12-month period is listed as 15.4 feet; the greatest number (43%) run from 14.7 to 16.6 feet.

TELL COAST GUARD WHEN HELP NO LONGER NEEDED, CAPTAINS URGED

Fishing vessels calling for emergency aid should notify Coast Guard immediately when assistance is no longer needed, the Search and Rescue Branch of the First Coast Guard District has urgently requested. The Fishing Vessel Safety Division of the National Marine Fisheries Service joins in this appeal.

Over 300 commercial fishing vessels from Maine, Massachusetts, and Rhode Island ports are aided each year by Coast Guard cutters, aircraft, and bases located from Eastport to Block Island. While most Coast Guard missions are completed safely, some vessels solve their own difficulties while help is on the way. These vessels continue their trips without notifying the Coast Guard.

A Wild-Goose Chase

This happened recently when a Gloucester (Mass.) trawler called for Coast Guard assistance while disabled in the Gulf of Maine. Coast Guard search and rescue units raced to assist the stricken craft. When they arrived at the reported location, there was no trace of the vessel. A long search of the area ended when the vessel was reported safely tied up in Gloucester harbor.

OKLAHOMA SCIENTISTS SEEK ANTIBACTERIAL AGENTS IN CORAL

NOAA has awarded a $161,800 Sea Grant to inland Oklahoma University for marine pharmacology work. Chemists under Dr. Alfred Weinheimer will isolate and try to produce useful compounds that demonstrate antibacterial, or similar effects, from coral and other marine invertebrates.

The Oklahoma marine-chemistry program is more than 15 years old. It has studied the extractable organic chemical content of several abundant coral-reef invertebrates from the Caribbean and other waters. The scientists have observed that many extracts demonstrate antibacterial activities of possible benefit to man. Recent experiments showed a high degree of antitumor and antileukemia action among certain compounds.

Practical Production Methods Sought

With the NOAA Sea Grant, the researchers hope to develop practical methods for producing useful compounds in quantity. They will give special attention to those aspects showing potential as anticancer agents.

The Oklahoma researchers collect tropical and subtropical invertebrates several times each year, mainly in the Caribbean. They have studied corals, sponges, and other materials.

The program is part of NOAA's Sea Grant effort in marine pharmaceuticals. In December 1970, NOAA awarded a Sea Grant to Osborn Laboratories of Marine Sciences of the New York Zoological Society to extract and test antibacterial agents from sponges.

SEA GRANTS FOR COASTAL-ZONE PLANNING, RESEARCH & TRAINING

NOAA has awarded $207,500 worth of Sea Grants for coastal-zone planning, for research, and for training:

1) $139,200, in 2-year project, to Nassau-Suffolk Regional Planning Board, Hauppauge, New York, to develop methods for planning the best use of coastal-zone marine resources. The project "will identify, classify, and analyze problems confronting decision makers dealing with marine resources."

2) A $50,000 Sea Grant to Lamont-Doherty Geological Observatory of Columbia University to continue its artificial upwelling project in the Virgin Islands. (See p. 16.)

The major emphasis during the next year will be on "food from the sea". This involves the growth of plankton and selected commercially valuable organisms.

3) The University of New Hampshire, Durham, was awarded $18,300 to give engineering students experience in the parts and systems used in ocean-oriented projects.

Students will continue to work on such projects as underwater life-support systems, shallow-water coring, and underwater tools. Each project is conducted by a team of students under one or more faculty members. In the project's first two years, 52 undergraduate and 17 engineering faculty members participated.

The 3 institutions will match at least half the NOAA Sea Grant with non-Federal funds.

LAMPRICIDE STUDY

A chemical used in Lake Michigan and Lake Superior to control sea lamprey--TFM--will be studied systematically for the first time by pharmacologists of the Medical College of Wisconsin, Milwaukee. NOAA has awarded it a $26,500 Sea Grant to study the metabolism and pharmacology of 3-trifluoromethyl-4-nitrophenol.

TFM is a selective lampricidal agent that has been effective in destroying the sea lamprey during its early development. Two or 3 parts of TFM in a million parts of water are lethal to sea lamprey larvae, while not affecting most other fish and aquatic species.

TFM's Achievement

Since TFM's introduction, the population of lake trout and white fish has increased substantially. The lamprey had nearly wiped out these fishes.

However, very little is known of how TFM works and what happens to it after it has done its job. No definitive studies have been made of TFM's pharmacology, metabolic fate in fish and mammals, and its possible environmental effects.

That is what the Medical College of Wisconsin will do.

STUDY CIGUATERA POISONING

Ciguatera poisoning, a tropical malady of humans and fish, will be investigated under a NOAA Sea Grant to the Caribbean Research Institute, College of the Virgin Islands, St. Thomas. Tropical islanders around the world fear the malady.

Dr. Robert W. Brody will seek to determine patterns of infection and food-chain relationships, and conduct laboratory analysis of the poison.

A Ciguatera Case Repository will be set up to gather clinical and pathological data from human cases.

Serious Problem

Ciguatera fish poisoning is a serious public health problem in the northern Leeward-Virgin Islands area. It slows the growth of the fishing industry so much that local fisheries provide only about 50% of the fish protein eaten.

The malady, apparently concentrated in tropical islands, has little effect on continental areas. It has been studied in the Pacific since World War II. There it is linked to a shallow-water food chain. The Caribbean scientists will be in close communication with University of Hawaii researchers.

Published Reports

About 4,500 persons in the world have had the illness since it was first identified; 542 deaths have been recorded. It affects the gastrointestinal and nervous systems. It usually develops 3 to 5 hours after an infected fish has been eaten.

FAO will cooperate with Sea Grant project. Its fishing vessel 'Alcyon' will provide fish samples and other data. NOAA's NMFS laboratory at Seattle, Wash., will also participate. It will provide chemical services in extracting and purifying the toxin.

Information Program

Medical reporting of ciguatera poisoning in the Virgin Islands is presently spotty. Individuals who become affected apparently seldom seek medical help. To obtain better data on symptoms and on suspect fish, the Sea Grant scientists plan to conduct an information program in the Virgin Islands. This will include TV and a brochure similar to one used in Japan and the U.S. trust territories to encourage people to report to medical authorities when they suspect that they have ciguatera poisoning.

TEXAS LAB TO PRESCRIBE MEDICINE FOR FISH IN MARICULTURE

Texas A&M University opened its new Aquatic Animal Medicine Laboratory January 11. The university says its College of Veterinary Medicine is the only one in the U.S. that has a medical-care program for marine animals.

"What we hope to do is be able to produce a cheaper and better seafood product," says Dr. George W. Klontz, associate professor of veterinary medicine, who is in charge of the lab.

Need for Mariculture

Ocean fishing is largely a hunter-type operation, Dr. Klontz adds. The ocean is being drained of its resources, and industry must devise more effective ways to produce food from the sea.

In mariculture, propagation in captivity of marine life, ocean water can be directed into ponds and the "livestock" cultivated.

"An example is a two-acre pond," Dr. Klontz notes. "You run sea water in one end, through the pond, and out the other end back to the sea. You stock the pond with fish, feed them and harvest them."

Disease Is Major Problem

A major problem so far with mariculture is contraction of disease.

"Of all animals presently being hatched in captivity, 25 to 50 percent don't get to the market because of disease," he says. "In some cases it runs even higher, but that's a good estimate."

Also, 30 cents of every dollar spent in mariculture enterprises goes to disease control.

12 Species For Lab

When the laboratory is stocked, Dr. Klontz says, 12 species of fish will be available for study and experimentation. Two species, albino catfish and Gulf topminnows, already are swimming nervously in 4 separate tanks.

He says the albinos were used because of their genetic homegeneity for measuring responses to viruses and bacteria; the topminnows for measuring a large spectrum of responses.

"These are our lab animals," he notes. "When commercial propagation of fishes becomes a reality, we hope to be ready to help when the diseases occur."

Lab Supports Sea Grants

The new laboratory will support the work of 4 Sea Grant projects in marine fisheries. The studies focus on bacteria and viral diseases of marine fish and shellfish, parasitic relationships, and histopathological studies of inflammation in fish.

Cooperative work with the Texas Parks and Wildlife Department also will be conducted.

Dr. Klontz points out that the university has the only vet college in the U.S. offering formal instruction in aquatic animals medicine at the preprofessional and graduate levels.

AT&T MAKES PROGRESS IN PROTECTING SUBMARINE CABLES

A 12-year effort by American Telephone and Telegraph Company's Long Lines Department to prevent fishermen from snapping submarine cables between U.S. and Europe is beginning to pay off. This is reported by New England Marine Resources Program.

The breaks are caused by snarling of gear in the cables. When these occur, hundreds of voices are silenced; repairs cost hundreds of thousands of dollars.

To ease problem, AT&T has: appealed to the fishing industry; offered free charts and brochures pinpointing the cables; offered to pay fishermen for nets and fouled gear that have to be cut away to avoid damage to a snagged underseas cable; maintained a North Atlantic patrol to warn trawlers away from cable routes; developed equipment and techniques that enable company to bury cable two feet under ocean floor, safe from commercial fishing tackle or natural disasters.

70 Cable Failures

In the past 15 years, there were 70 cable failures on the 4 transatlantic telephone cables; 54 were on this side of Atlantic. Two were caused by icebergs, the remainder by trawlers or scallopers. AT&T feels that elimination of breaks caused by fishing is key to preventing cable failures. AT&T says it can no longer depend on selecting routes to avoid fishing grounds because fishing areas have extended considerably in the past 12 years and have overrun new cables. Routes that were free of trawling when cables were placed are now vulnerable.

TATS 1-5

The first transoceanic telephone cable system, TAT-1, was put into service in 1956. Since then, 4 more have been placed along ocean floor. When TATS 1 through 4 were in planning stage, prime importance was given to routes outside fishing grounds. TAT-1 was charted north of Grand Banks in Newfoundland, where fishing mainly for cod was heavy. A change in fishing methods and consumer tastes in the late 1950s drew trawlers farther north, where cables were located. Soviet fleets with refrigerated trawlers began to process ocean perch, a highly perishable catch formerly ignored by fishermen. Eventually, trawlers from 13 other nations began fishing near the cable routes.

A Break In 1959

"The first break in service occurred in February, 1959, when a Russian trawler accidentally snagged TAT-1," AT&T stated. Its air patrols began that month to augment ship patrols designed to warn trawler captains when they are too near a cable. Two ships patrol Cabot Strait and the North Atlantic trawling area; they are ready to repair a snapped cable. The air patrols drop leaflets printed in 6 languages warning captains of their closeness to submarine cables. Cooperation has been good.

'Shoes' Kick Cables

It isn't the trawling nets themselves that cause the cable breaks. The 'culprit' is the large oak and metal "shoes," called otter

boards, which scrape along ocean bottom holding open the great nets. If otter board scoops up cable instead of riding over it, the cable is likely to be snapped.

In 1965, Woods Hole Oceanographic Institution, Cape Cod, Mass., discovered a rich scallop bed off New Jersey through which a cable had been placed. New England and Canadian fishermen converged on the area. Cable breaks became numerous, mostly from scallop dredges being dragged repeatedly across bottom. In one instance, 7 miles of cable had to be replaced and, in one period, repairs cost over $350,000.

Going Underground

This was when AT&T was trying to convince fishermen to weld a small metal addition to their dredges between the shoe and the dragging frame. This would allow gear to slide up and over a cable instead of hooking onto it. This did not eliminate problem, so AT&T solved it by burying sections of new cables near this area in 1966. It was the first underground cable along an ocean bottom.

Working cable into the ocean floor is always preceded by an oceanographic survey. A Bell-designed, 7,000-pound survey vehicle with communications and measuring instruments collects underwater information. Towed by a cable ship, this vehicle has a weighted steel wheel to cut through the soil.

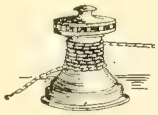
Cooperation With Fishermen

AT&T is asking fishermen to help where cable lines lie exposed on ocean floors, and where it is impossible or impractical to bury the cable. Its charts are highly detailed and show exact cable positions. AT&T points out that snagging cables can also be costly to fishermen. Fishermen have lost fishing time and up to $8,000. The company is willing to replace snarled nets. It has done so 12 times at a cost of about $2,000 each time.

AT&T emphasizes danger fishermen expose themselves to when they cut cables to free meshed gear. Telephone cables carry up to 5,000 volts of electricity, considerably higher than telegraph cables.

Successful Burial

The successful burying of cable has increased reliability of international communications. It has reduced AT&T patrol and repair costs from fishing damage or natural events--undersea landslides, icebergs, currents, surf action, and rough ocean-bottom conditions. Shorter cable routes are possible because commercial fishing locations do not have to be circumvented.



CALIFORNIA'S GIANT KELP

In 1968, the California Legislature directed the Department of Fish and Game to prepare "a comprehensive master inventory and preliminary master plan for utilization of all ocean fish resources from existing scientific information. . . ."

The deadline was the 5th legislative day of the 1971 Regular Session. The department has prepared "California's Living Marine Resources And Their Utilization," a 148-page work. "It concerns itself primarily with the living marine resources that enhance the wealth of this State and provide for recreational benefits for the people. It does consider some of the effects of man's activities in coastal areas of California as well as some problems confronting the State's fishing industries."

The following is reprinted from the California publication:

History of the Harvest

Marine plants have been used in many parts of the world for hundreds of years as a food supplement for humans and animals. The giant kelp, Macrocystis, has been harvested commercially and processed in California since 1910. Except for a few innovations to reduce spillage and speed up the cutting and loading process, kelp still is harvested as it was over 50 years ago.

Kelp contains carbohydrates, minerals, vitamins, and algin or alginic acid. During World War I, potash, acetone, and iodine were the chief products recovered from kelp. Kelp meal, used as an animal food supplement, and algin, used in many modern products, are the most important items today.

Algin, a colloidal substance extracted from kelp, has the unique property of absorbing large quantities of water. This property makes it important in preparing commercial ice cream since it prevents water from forming coarse ice crystals. Algin also has suspending, stabilizing, emulsifying, gel-producing, film-forming, and colloid-forming properties which render it valuable in other processes. It is used in pharmaceuticals to suspend drugs and antibiotics such as penicillin. Algin is important in the preparation of adhesives for containers, coatings for welding rods, and to hold fiberglass mats together. The textile industry uses it for thickening and stabilizing dyes. At present, there are more than 200 uses for algin.

The annual California kelp harvest has varied from a high of 395,000 wet tons in 1918 to a low of 260 tons in 1931, but averaged 129,000 wet tons during the 10-year period (1960-1969). No adverse influence on the rich fauna associated with kelp beds can be attributed to harvesting as currently practiced.

Kelp beds are numbered and designated beds may be leased for a 20-year period. Commercial kelp harvesters may lease two-thirds of the kelp beds in California; however,

the remaining one-third is not leased and may be harvested by any company. These are called open beds. Commercial harvesters bid for the privilege of exclusive use of leased beds. A single entrepreneur may not lease more than a total of 25 square miles or 50 percent of the total kelp areas, whichever is greater. Every harvester must purchase an annual license and pay a royalty per ton of wet kelp harvested. Over or under harvesting a leased bed constitutes a violation of the lease agreement, and a fine and loss of the exclusive lease can occur.

Giant kelp is harvested by specially built barges. These vary in size and some are capable of carrying up to 300 tons of wet kelp. Kelp is cut to a maximum depth of 4 feet (by regulation) below the water's surface and is transferred by a conveyor belt into the open hold of the barge. It then is transported to a processing plant where it is transformed to a salable product.

Status of Biological Knowledge

Giant kelp ranges from Sitka, Alaska, southward to Pt. Abreojos, Baja California; nevertheless, kelp harvesting has been centered in southern California. Kelp grows in water from just outside the surf to depths of 100 feet. The plant has a root-like structure called a holdfast which clings to a hard rock or shale substrate.

Giant kelp is a perennial, living and sending up new stalks called stipes for a period of 5 to 10 years. These stipes reach the surface to form a canopy, and live for about 6 months. There is a constant succession of new stipes growing to the surface to replace dead and dying ones, and a single holdfast may have more than 100 stipes. A young plant takes about 1 year to become established. Under favorable conditions, a young plant will double in size every 3 weeks. Growth and reproduction are limited by the available light (water clarity and depth), temperature, amount of available rocky substrate, nutrients present, number of grazers in area (opaleye, sea urchins, abalone, and other gastropods), disease (black rot), storms, and by heated water discharges and sewage outflows in the area.

Growth is primarily from the terminal tips of the stipes. Nutrients are taken from the surrounding water in the presence of sunlight during the process of photosynthesis. Rapid growth may follow an increase in the amount of plant food present in the water. During periods of optimum conditions, which consist of clear, cool waters, below 66° F, enriched with nutrients upwelled to the surface, giant kelp stipes have been observed to grow from 12 to 24 inches in a single day. When water temperatures reach 66° F, growth is arrested and sloughing occurs.

Giant kelp has a fascinating reproductive system. There are two different forms in the life cycle of the species. The sporophytes (the large plants making up the kelp beds) liberate billions of spores which give rise to microscopic plants known as gametophytes. The male and female gametophytes in turn give rise to sporophytes. The reproductive tissue of the sporophyte is located in specialized blades at the base of the plant. While individual plants fruit at specific times during the year, within any one kelp bed reproduction occurs throughout the year.

Grazers, such as sea urchins, may have a tremendous impact on kelp beds when ecological conditions permit their populations to reach large numbers. Environmental conditions created by sewage outfalls in southern California have led to the establishment of large urchin populations in certain areas. Urchins not only destroy the existing kelp, but keep young plants from becoming established. Once the kelp is gone, the urchins are able to survive by living off the sewage discharge nutrients. Research indicates an urchin also may absorb up to 50 percent of its minimum daily nutrient requirements from the surrounding water. In this manner, large urchin populations continue to exist in areas that formerly contained kelp beds.

Kelp beds can be restored. Sea urchin populations can be controlled by man. The kelp bed at Point Loma, near San Diego, has been restored almost to the same size it was 20 years ago. In addition to physically or chemically killing the sea urchins, several other techniques have been developed to assist in kelp restoration. Juvenile plants have been cultured in the laboratory and planted at suitable sites. Adult plants have been transplanted. Work is underway to develop mass culture techniques. Spore production and dispersal rates have been studied, and light requirements of the microscopic stages of kelp are being investigated. Efforts continue to upgrade water conditions along the coast.

One side effect of disappearing kelp beds is the loss of fish habitat. Areas that once sustained considerable sport and partyboat fishing pressures now provide very little support to these fisheries. Unfortunately, loss of kelp beds has been the largest in areas where fishing pressures are the greatest. In these same areas, the need for high aesthetic values in the inshore marine environment is possibly the greatest in California because of their proximity to large metropolitian areas.

Status of Population

California kelp beds have decreased in size since the early 1900's when they covered approximately 100 square miles. Today they cover less than 75 square miles. There are 74 designated kelp beds along the California coastline. These cover 53.86 square miles south of Point Conception, including the offshore islands, and 15.5 square miles between Point Conception and Point Montara. In the last 10 years, some of the major kelp beds of southern California have all but disappeared due to temperature changes, sewage discharges, and kelp grazers. Kelp habitat improvement projects, initiated in 1963 by industry and the academic society, have restored the Point Loma kelp bed near San Diego to a point where it again can sustain a commercial harvest. Increased numbers of heated water discharges could pose a threat to the kelp resources of California in the future unless special effort is made to keep the warm effluent away from kelp beds.

SEASONAL AND GEOGRAPHIC CHARACTERISTICS OF FISHERY RESOURCES

California Current Region--V. Northern Anchovy

David Kramer and Paul E. Smith

The resource of the northern anchovy, Engraulis mordax, off the coasts of California and Baja California has been estimated to have grown from 640,000 tons in 1951 to a spawning biomass fluctuating between 5 and 8 million tons since 1962 (Smith, MS). (Estimates from various sources, 1940-41 to 1965, were compiled by Messersmith in 1969--Table 2.) The growth has been attributed, in part, to the anchovy's occupation of the niche left empty by the Pacific sardine during its decline. In 1966, Ahlstrom depicted this phenomenon in comparing the relative abundance and distribution of the larvae of the two species for 1954 and 1962 (Figs. 1 and 2). Data from fossil scales, presented by Soutar (1967) and Soutar and Isaacs (1969), offer an alternate explanation to the anchovy's filling the sardine's niche. They imply that fluctuations in the populations of these two species may have been independent of one another in different periods over the last 2,000 years.

In 1964, the California Cooperative Oceanic Fisheries Investigations (CalCOFI) Committee proposed to the California Marine Research (MRC) Committee that a 200,000-ton harvest be allowed for reduction purposes on the hypothesis that a fishery for this species might help to restore the sardine resource; once restored, proper management could maintain a balance between the two resources. This was detailed by Messersmith in 1969.

Seasonal and Geographic Distribution

Two sources of information are available on the seasonal and geographic distribution of the anchovy population. One is a tagging study in 1966-69: the California Department of Fish and Game (CF&G) tagged anchovies from San Francisco, California, to Ensenada, Baja California, to determine their migratory habits and to obtain estimates of their population size and mortality rates (Haugen, Messersmith and Wickwire, 1969). Recoveries of tags indicated northerly movement during late summer and southerly movement during the winter. The data were insufficient to determine the sizes of the population mortality rates, or total distribution, because of the low level of the reduction fishery during that period of the study and lack of catch statistics south of Ensenada.

Vrooman and Smith (MS), using serological data, estimated the same movements in a central subpopulation of the anchovy between Pt. Conception, California, and Cedros Island, off Baja California. This subpopulation is included in the area depicted by Haugen, et al. (1969) for their tagging work.

The second source are the data of the CalCOFI, which show the seasonal and geographic distributions of anchovy larvae, cruise by cruise, for 1951-65 (Kramer and Ahlstrom, 1968), and in summaries for eggs and larvae for 1951-60 (Figs. 3 and 4) over the full range of the investigations.

Summarized data can be used to predict the times and locations of adult fish spawning as described by Kramer and Smith (1970a) in the first report in this series, where the organizations, area of investigations, and treatment of the data were presented.

Unlike our previous reports, which used either all eggs or all larvae for the summaries (Kramer and Smith, 1970a, b, c, d), we are using both for the anchovy; for the larvae, we are using the 5-mm size only, the most abundant in the plankton hauls.

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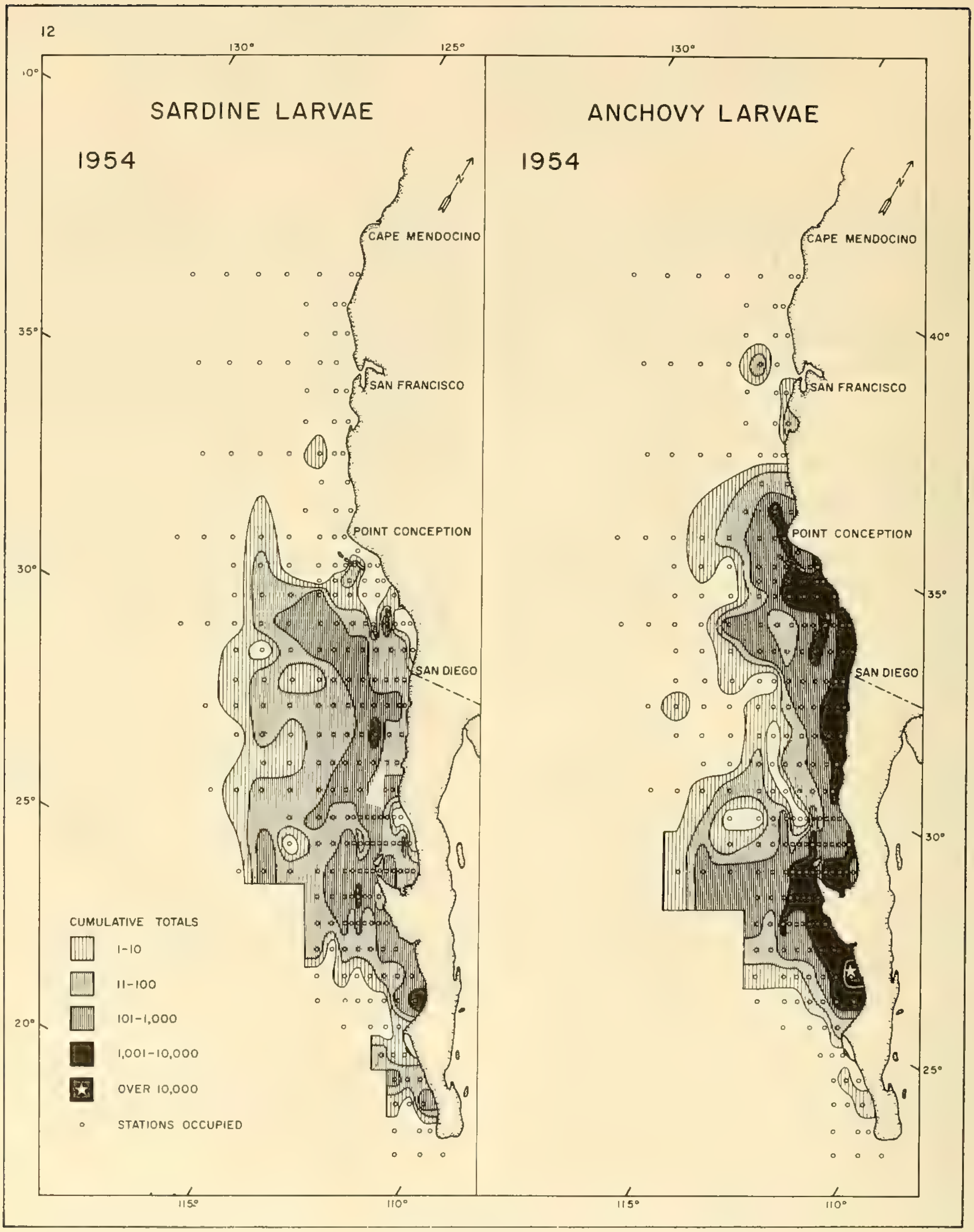

Fig. 1 - Distribution and relative abundance of sardine and anchovy larvae in 1954 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). (Fig. 2 of Ahlstrom, 1966.)

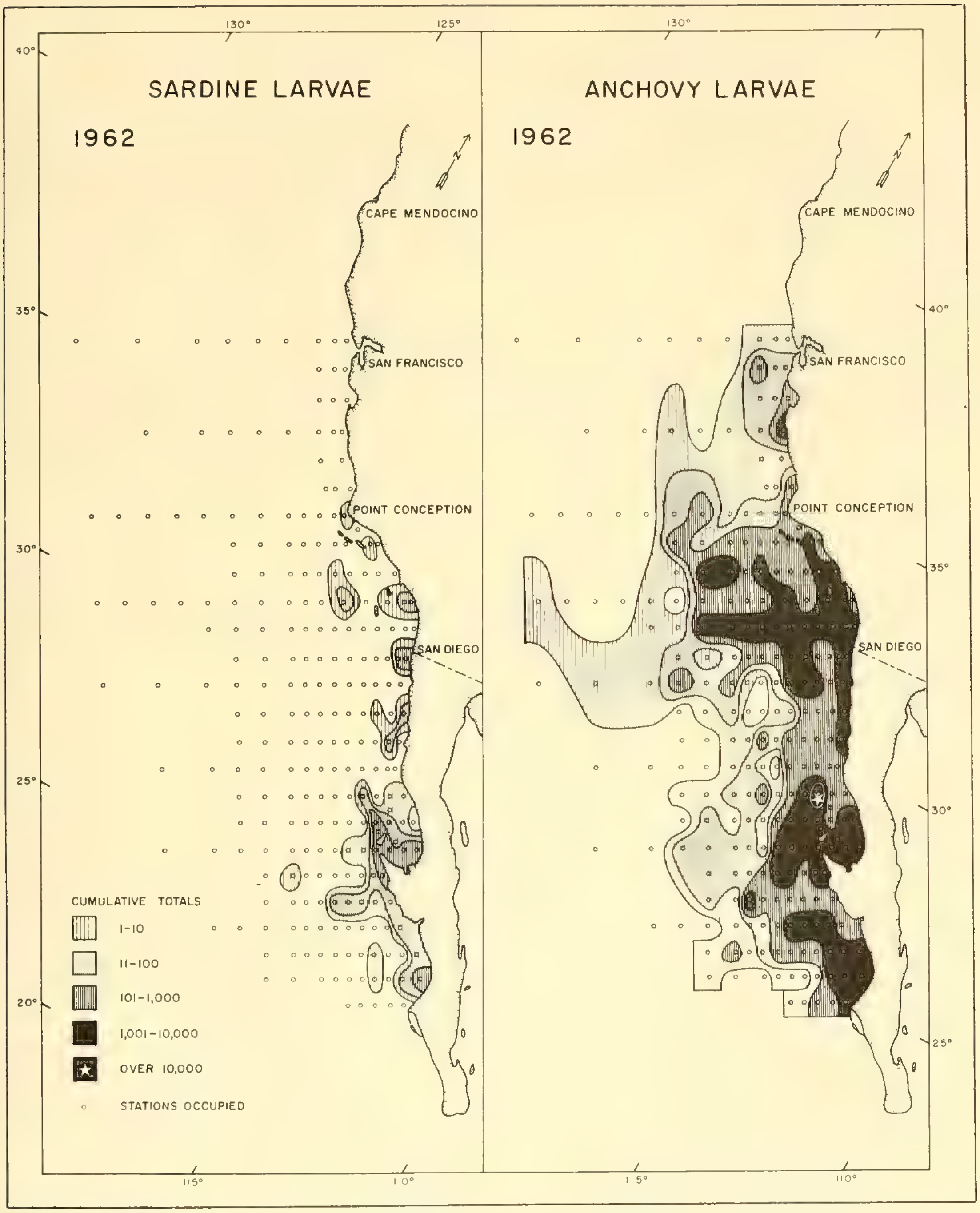

Fig. 2 - Distribution and relative abundance of sardine and anchovy larvae in 1962 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). (Fig. 3 of Ahlstrom, 1966.)

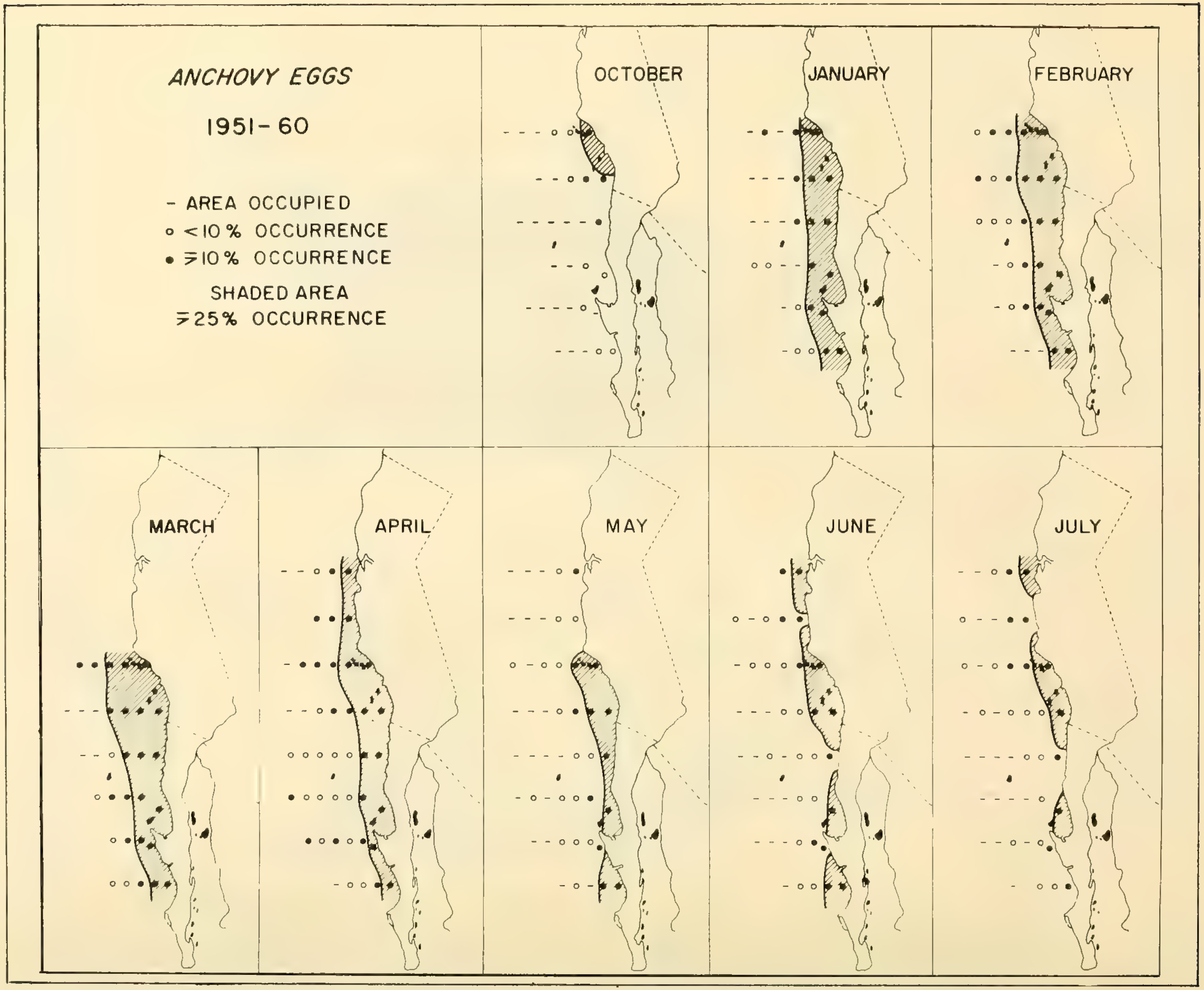

Fig. 3 - Percent occurrence of Anchovy eggs in 1951-60 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). Each circle, line or dot represents a pooled statistical area (see Kramer and Smith, 1970a).

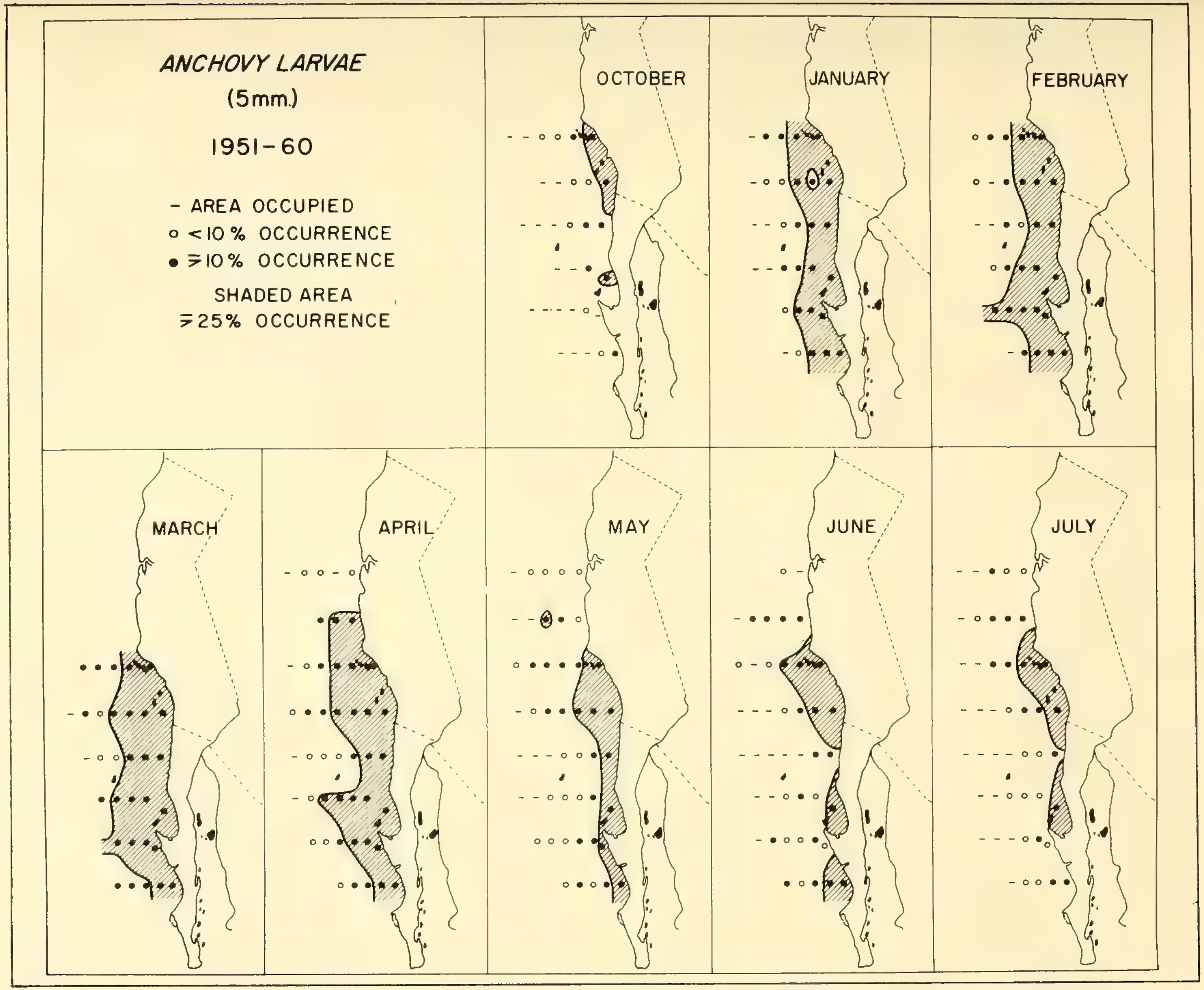

Fig. 4 - Percent occurrence of 5-mm anchovy larvae in 1951-60 on the survey pattern of the California Cooperative Oceanic Fisheries Investigations (CalCOFI). Each circle, line or dot represents a pooled statistical area (see Kramer and Smith, 1970a).

The eggs and larvae show only slight differences in the extent of their distributions in the same month for which each is shown. The major centers of spawning (25% or more occurrences in plankton hauls) are evident first in January from Pt. Conception, California, to Pt. San Juanico, Baja California, and about 50 miles seaward. The north to south extents remain the same through April, with some increase seaward and northward to San Francisco. The southern extent remains the same in May, June, and July, but the northern limit varies between Pt. Conception and San Francisco. By October, the centers are located only off southern California and sometimes southward. The data for August, September, November, and December were insufficient for summarization to show the trends depicted in Figs. 3 and 4.

The Fishery

Until the 1965-66 season, when a reduction fishery was allowed by the California Fish and Game Commission for the northern anchovy in California, the resource had been virtually untapped. Major usage was in commercial landings restricted to canning and in landings for live and dead bait. Total use, including the new fishery for reduction, was summarized by Messersmith (1969) in his review of the industry through 1967, and by Hardwick (1969) for the fishery through 1968.

Landings for reduction have been strictly limited and controlled by the California Fish and Game Commission to quotas by zones and areas along the California coast with some slight changes from year to year (Messersmith, 1969; Hardwick, 1969). Quota totals were 75,000 tons for each season, 1965 through 1969. The quota total was raised to 100,000 tons for the 1970-71 season. Anchovy landings 1964 through 1969 are shown in Table.

Anchovy landings 1964 through 1969
(source - California Department of Fish and Game)

Year	Reduction	Other commercial	Live bait	Total
1964	0	2,488	5,191	7,679
1965	170	2,866	6,148	9,184
1966	27,335	3,705	6,691	37,731
1967	32,349	2,455	5,387	40,191
1968	13,795	1,743	7,176	22,714
1969*	65,099	2,533	5,538	73,170

*Preliminary.

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KILLER WHALES PURSUE SEA LIONS IN BERING SEA DRAMA

Jim Branson
NMFS Fisheries Management Agent

On Jan. 23, 1971, during a patrol aboard the Coast Guard Cutter 'Storis' in the Bering Sea, I observed a pod of 7 killer whales (Grampus vectipinna) pursue a band of 20 to 25 Steller sea lions (Eumetopias jubata) around a Soviet SRTM trawler for over an hour.

At 3:15 p.m., on January 23, the Storis came up alongside the Soviet SRTM trawler 'Iskra', which had just begun to haul its gear from a depth of 440 fathoms. Its position was 54-18 N. 167-51 W., approximately 35 miles NW of Point Kadin on Unalaska Island, and 24 miles E of N from Bogoslof Island, a very large sea lion rookery.

At the time, there were 9 SRTMs operating in this immediate area. Each had an accompanying band of sea lions, waiting to garner what fish they could when the gear was pulled. Each group of sea lions averaged between 20 and 30 animals.

Drama Unfolds

As the Storis came alongside the Iskra, a group of killer whales was noticed about 600 yards from the ship. There were 7 whales: 4 adults, two subadults, and one apparently quite young juvenile; they were making a direct approach on the Iskra. As they got within a hundred yards or so, the sea lions showed obvious signs of panic, clustering together in a very tight group and staying alongside the trawler, literally brushing the hull. As the whales made a close approach, the sea lions would mass and dive under the SRTM, or swim around the bow or stern of the ship seeking safety on the other side. The whales would follow either by sounding or by going around the ends of the ship, at which time the sea lions would immediately retreat to the dubious safety of the opposite side.

A Lion's Probable Death

As long as the sea lions stayed tightly massed, the whales did not attack, but did make continuous close approaches on the sea lions. After about 20 minutes of this, the sea lions were momentarily caught at a disadvantage a few feet from the stern of the SRTM, and two of the whales leaped clear of the water in a dash on the sea lions. A small group of sea lions, 5 or 6, apparently panicked and split off from the main group; they got as much as 200 yards away from the ship. At this time I believe one sea lion was taken, although I could not be sure. The proximity of a whale to a single sea lion, and the latter's sudden disappearance, make it likely that this animal was actually attacked and probably killed. I was unable to see any blood on the water, however.

Another Kind of Surveillance

It was obvious at the end of an hour of this that the sea lions were getting quite tired. They had been moving very rapidly all this time. The whales continued to maintain a very close surveillance, approaching to within a few feet of the SRTM and the cutter. At one time, the two largest whales in the pod stationed themselves side by side facing directly toward the bow of the SRTM. Most of their back--from well forward of the blowhole to well aft of the dorsal fin--was awash. They maintained this position with a cold and beady eye on the sea lions, which were clustered tightly under the SRTM's bow.

Denouement A Mystery

The SRTM required 40 minutes to get its doors aboard from the time it started hauling, 15 minutes to bring the cod end aboard, and another 10 minutes to reset and stream the net as it got underway. We left the area at this time and the whales were still in the immediate vicinity of the SRTM; the sea lions were doing their best to stay either on or alongside of the net which was streaming on the surface, or as close to the ship's hull as they could possibly get.

I'm sure the sea lions would happily have climbed aboard the ship if the sides had just been a little lower.

Fig. 1 - HOT PURSUIT: 4 killer whales round ship's bow in close pursuit of sea lions.

Fig. 2 - Pod of sea lions sheltering under bow of Soviet SRTM watch approach of 3 killer whales. (Photos: Jim Branson)

"Ocean Life" (In Color), by Norman B. Marshall, 290 illustrations, many drawn from living specimens by Olga Marshall, 214 p., $4.95. The Macmillan Co., Publishers, 866 Third Avenue, New York, N. Y. 10022.

A handbook of life in the oceans, handsomely illustrated in color. Dr. Marshall has designed it as a reference of current knowledge about the oceans beyond the tide marks.

He describes "the physical nature of the oceans and their fringes, and the history of exploration of the oceans' life forms." He outlines the "different environments and patterns of marine life, the life history of various groups and their ecological relationships."

The book contains a catalogue of various genera of life forms to match the 290 illustrations of particular species. There are underwater photos of corals. Mrs. Marshall painted some illustrations especially "to capture the transparent characteristics of jelly-like organisms."

"Sounds of Western North Atlantic Fishes (A Reference File of Biological Underwater Sounds)," by Marie Poland Fish and William H. Mowbray, 207 p., illus., $12.50. The Johns Hopkins Press, Baltimore, Md. 21218.

"In 1954 the Office of Naval Research requested the Narragansett Marine Laboratory to institute and maintain a reference file of biological underwater sounds which would be an up-to-date reference library of the recorded sounds of identified marine animals. To identify with precision and certainty sounds monitored in the field without seeing the organism that produced them is considered impossible by many investigators; such identification must be circumstantial, at best. However, certain information is useful in tentatively determining the source of sounds under such conditions; therefore, supplemental data are included here on distribution, ecology, and behavioral patterns of fish which may influence the occurrence of biological underwater sounds.

"Through our own research activity this library now contains characteristic sounds of numerous invertebrates, at least 24 marine mammals from both the Atlantic and Pacific oceans, and over 150 fish species recorded during experimental monitoring of some 300 species representative of coastal waters from Canada to Brazil. This report is limited to 220 species in 59 families of fishes studied by us along the Atlantic coast of the United States and in the Caribbean islands. Sound analyses, illustrated by 160 spectograms and 329 oscillograms, are presented for 153 species in 36 families. For each species, information is included on distribution, habits, size, sound production, and sonic mechanism."

"Fish and Invertebrate Culture--Water Management in Closed System," by Stephen H. Spotte, and Foreword by James W. Atz, 1970, 145 p., $8.95. Can be obtained from John Wiley & Sons, Inc., Publishers, 605 Third Avenue, New York, N. Y. 10016.

The book "shows how to culture freshwater and marine fishes and invertebrates in closed-system environments by controlling the chemical and physical factors in the water affecting their normal physiology.

"Part 1, Effects of Animals on Captive Water, treats biological, mechanical, and chemical filtration and the carbon dioxide system. Part II, Effects of Captive Water on Animals, deals with respiration, salts and elements, toxic metabolites, disease prevention by environment control, and laboratory tests.

"Fish and Invertebrate Culture offers the culturist both theoretical and practical information. For example, nitrification is discussed, along with its practical applications, such as how to construct and operate a biological filter. The chemical filtration techniques using activated carbon, ion exchange resins, air-stripping, ozone, and UV irradiation are also dealt with, both in theory and in practice. There are instructions for mixing large volumes of synthetic sea water, discussions of the best buffer materials, and formulas for calculating the carrying capacity of a culture system.

"Special features include line drawings of water management equipment and equipment functions, practical and up-to-date tables, and an extensive bibliography."

"Ferro-Cement Boat Construction," by Jack R. Whitener, 128 p., illus., $7.50. Cornell Maritime Press, Inc., Cambridge, Md. 21613.

"Here is a practical guide to every phase involved in construction of the hull, finishing and fitting out of ferro-cement boats. It also includes the following reports of vital interest to those contemplating construction:

"I: An Investigation of 'Ferro-Cement' Using Expanded Metal--by J. G. Byrne and W. Wright.

"II: Some Notes on the Characteristics of Ferro-Cement--by Lyal D. G. Cullen and R. W. Kirwan.

"The plan sections contain outline examples of four plans readily available in full scale . . . an 18' Auxilliary Cruiser, a 25' Cruiser, a 38' Sailing Ketch and a 54' Trawler."

CANADA

VALUE OF 1970 LANDINGS IN MARITIME PROVINCES SETS RECORD

In 1970, the value of fishery landings in Canada's Maritime Provinces set a record, according to the Department of Fisheries and Forestry. The Maritimes are Nova Scotia, New Brunswick, and Prince Edward Island.

Preliminary data show that about 20,000 fishermen landed 1,129 million pounds of fish worth C$80 million. These compare with 1,232 million pounds valued at C$76.7 million in 1969, and 1,372 million pounds for C$73.8 million in 1968.

Strikes Play Big Role

The 1970 decrease in landings, compared to 1968 and 1969, was due mainly to a drop in herring landings. The subnormal groundfish landings were partially due to a fishermen's strike. No offshore fish were bought from late March until early fall by major processors in Canso, Mulgrave, and Petit de Grat because about 250 trawler fishermen were on strike.

Strikes by shore workers during 6 weeks in February and March at major fish plants in Louisbourg, Halifax, Lunenburg, and Lockeport also contributed to decline in groundfish landings.

Another factor was ICNAF closure of haddock fishery during March and April in two large areas (part of northeast Georges Bank, Browns Bank, and part of Emerald Bank).

Unfavorable December 1970 weather resulted in fewer lobsters landed in western Nova Scotia than during December 1969.

Record Volume & Value

There were record catches and values of redfish or ocean perch and shrimp landed. Record values too were set for hake, flatfish, and clams.

Fishermen harvested 106 million pounds of Irish Moss, worth C$2.9 million, a record.

The Most Valuable

In order of rank, lobsters (31.6%), scallops (16.1%), herring (9.6%), cod (9.6%), haddock (6.3%), and flatfish (5.6%) were 78.8% of total value.

Leading Species

The leading species landed were herring (579.2 million pounds, C$7.7 million), mostly in Nova Scotia (N.S.) and New Brunswick (N.B.); cod (142.6 million lbs., $7.7 million) mostly in N.S.; ocean perch or redfish (88.9 million lbs., $2.9 million) mostly in N.S. and N.B.; flatfish (88.4 million lbs., $4.5 million) mostly in N.S.; mackerel (32.2 million, $1.2 million) mostly in N.S.; lobsters (30.7 million, $25.3 million); and scallops (11.8 million, $12.9 million).

Landings by Provinces

By provinces, the landings were: N.S. 590.7 million pounds ($53.3 million), N.B. 438.4 million ($17.2 million), and P.E.I. 100.4 million ($9.6 million).

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MARINE SPORTS-FISHING LICENSES TO SUBSIDIZE HATCHERIES

Nonresident sports fishermen in Canadian tidal waters will pay a license fee based on vessel size. All proceeds will go to build coho and spring-salmon hatcheries.

The license fee for privately owned vessels will range from C$15 to $75, depending on length. Charter and rental boats servicing nonresident sports fishermen will be classed commercial. These fishermen will pay the same license fees as fishermen in salmon fleet, $100-$400.

Exceptions

Only charter or rental Canadian boats under 30 feet will not pay license fee. This will exempt most marinas renting small boats on a daily or hourly basis.

The new fees structure will go into effect in 1972. A $400,000 return is expected during first year. Licenses will be available from any office of Department of Fisheries, and mail applications will be accepted. ('Fisheries News', Dept. of Fisheries of Canada, Jan. 29.)

EUROPE

NORTH SEA MACKEREL FISHERY OVEREXPLOITED

Until the mid-1960s, the mackerel stock in the northern North Sea and the Skagerrak was underfished. The annual catch of Danish, Norwegian, and Swedish fleets during the 1950s fluctuated between 10,000 and 20,000 metric tons.

In 1964, many new large purse-seine vessels with power blocks were introduced. The Norwegian catch doubled. It multiplied each year until it peaked at 868,000 tons in 1967. Thereafter, catches declined each year to 683,000 tons in 1969. The indications of excessive fishing were clear, and severe restrictions were imposed in 1970; the catch reached only 293,000 tons.

Fewer Fish

Now, scientists believe the stock has been overfished. Based on tagging research by Norwegian biologists, estimates of mackerel in the area showed fewer fish than would be caught in a good season. Like other species, the size of the year-classes entering the fisheries has fluctuated yearly and recruitment has not been good.

Outlook Poor

The present outlook for North Sea and Skagerrak mackerel fishery is poor, but biologists hope that the good 1969 year-class will remain plentiful until its productive age. They expect Norwegian catch regulations to be helpful.

If stock size can reach about one million tons, the annual catch might reach 400,000 tons. The stock can be utilized better in a controlled fishery. But with fishery at its maximum sustainable yield, there will be fewer larger fish. ('Fiskeribladet')

ITALY

IMPORTS 45,000 TONS OF FROZEN TUNA DESPITE HIGH PRICE

Of all Japanese products imported into Italy, frozen marine products, mostly tuna, account for about 20% of value. In 1970, Italian demand was greater than supply, and frozen tuna brought record prices. These high prices were expected to continue.

High Prices In 1970

In December 1970, the price of tuna (cost, insurance, freight Italy) reached US$610-640 a metric ton for round yellowfin; $880-930 for semidressed yellowfin; $940-990 for dressed yellowfin; $880-930 for semidressed big-eyed; and $640-700 for dressed big-eyed.

Despite such high prices, total Italian imports of frozen tuna in 1970 were about 45,000 metric tons, down from 48,835 in 1969.

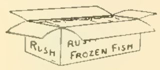
Italy's 45,000 MT Quota

Italy allocates an annual quota of about 45,000 metric tons of frozen tuna free of import duty. The imports are processed by Italian canneries into canned-tuna-in-olive-oil, almost all consumed domestically.

In 1970, Italy imported frozen tuna from Japan, S. Korea, Taiwan, U.S., Cuba, France, and South Africa.

No Sharp Price Decline

Price this year will not decline sharply so long as Italy imports a reasonable quantity to keep the monthly capacity of her canneries (about 4,000 metric tons) balanced. However, the current price of nearly $1,000 is considered too high. About $800 for dressed yellowfin will be break-even point for canneries. ('Suisancho Nippo', Jan. 11.)



ICELAND

TRAWLER FLEET EXPANDS

The failure of the herring fishery in recent years has renewed Icelandic interest in trawling. Greater effort increased landings of cod, haddock, and other groundfish. Favorable resource conditions, strengthened markets for frozen fish, and better export prices also influenced the catch.

In 1969, the groundfish catch was the largest since 1960. According to the Fisheries Directorate, the 1970 catch will show further large gains, with cod alone up 24,000 metric tons.

Groundfish Fleet Encouraged

Good fishing by the groundfish fleet in 1969 strengthened vessel owner-operators sufficiently to encourage them to better equip their fleet.

Good catches continued in 1970. The favorable 1964-66 year-classes now promise good catches in 1971 and 1972.

The principal fishing grounds have been in Icelandic coastal waters, mainly along the south and west coasts.

Cod Emphasized

Emphasis on cod is being encouraged for the smaller (up to 200 tons) and the larger trawlers. The government has approved bids for 8 new 1,000-GRT stern trawlers; also five 500-GRT stern trawlers will begin fishing soon.

Year of Stern Trawler

Last year was the year of the stern trawler. At the beginning of 1970, Iceland owned 1 small stern trawler; by year's end, 5 others were built and fishing; and another was being built. Also, eight 1,000-GRT stern trawlers were under construction for government and private interests: 2 in Poland, 4 in Spain, 2 in Iceland.

Of the 500-ton trawlers, one 550-ton vessel purchased in W. Germany is fishing and another is being built.

The purchase of three 3-year-old French trawlers has been agreed on. (Reg. Fish. Attaché, Copenhagen, Jan. 26.)

DENMARK

80% OF ANNUAL 1,000-MT AGAR PRODUCED FROM LOCAL SEAWEED

Denmark produces about 1,100 metric tons of agar annually: about 80% from locally harvested seaweed, the balance from imported gelidium. In 1969, production totaled 1,162 tons; about 90%, worth US$1.7 million, was exported.

The raw material is called "Gaffeltare" (Furcellaria Fastigiata); the extract is "furcellan". Furcellan is sold in powder form and is known as Danish agar.

A Barber's Brain Wave

Production began in 1943, when a barber trying to make a permanent-wave lotion from seaweed found the algae contained a mucilaginous substance that became gelatinelike on cooling. It was used during 1944/45 as a bacteriological gel, when Japanese agar supply was cut off. Most of present product is used to stabilize foods.

Agar From Seaweed

Four Danish firms have produced agar from seaweed. Five or six vessels work continuously using a special trawl that collects the weed. Production of seaweed, from offshore waters 4 to 15 meters deep, is around 25,000 metric tons a year. The agar content varies from 2%-5% of raw-material weight.

The largest amounts have been taken in Kattegat north of Djursland, where concentrations of loose and drifted weed seem to gather. Large harvests in 1961-65 reduced the resource seriously. The industry was in critical shape in 1966 and 1967 until new resources were located that could be taken by trawl. Imports started in 1964.

Exports Exceed Local Use

Since 1949, exports of agar have far surpassed domestic use. In 1969, the principal markets were W. Germany, France, Great Britain, Italy, Spain, Switzerland, Mexico, Argentina, and the Netherlands. Small quantities go to many other countries. (Reg. Fish. Att., Copenhagen, Jan. 19.)

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DENMARK'S SHRIMP FISHERIES

Denmark's shrimp catch comes from 2 main sources: North Sea area and West Greenland. In 1969, the catch of deep-water shrimp (Pandalus borealis) from North Sea and Skagerrak was 5,434 metric tons. In Greenland waters, the catch totaled 5,982 tons. Also, about 347 tons of common shrimp (Paelamen fabricii) were caught mainly in Belt Sea and Baltic area.

Fishery Began In 1931

The Danish shrimp fishery started in 1931. The catch rose steadily, peaked at 6,204 tons in 1968, and now seems to have leveled off. At first, main source was the Skagerrak and, later, mainly the North Sea. In 1960, fishing began on Fladen Ground, between Scotland and Norway; now the bulk of catch comes from there.

Greenland Shrimp Fishery

The Greenland shrimp fishery started on a small scale for canning in 1935. It was dormant during World War II. In 1947, it resumed and, during 1949, good resources were found in Disko Bay area. Since then, output has risen steadily. Now, it equals and frequently exceeds Denmark's level.

Because overfishing threatens Greenland less, the potential there appears much better than in Denmark. Fishing can be carried out only in limited areas, where bottom conditions are favorable. So any temporary overfishing soon is compensated by entry of shrimp from outside areas. Catch rates are greater in Greenland: for the most part, over 50 kilograms per hour and, in some cases, 100 kilograms or more. In Denmark, average catches run under 50 kilograms an hour.

Scandinavian Market

In Denmark and other Scandinavian countries, shrimp are sold fresh-cooked and peeled, in light brine, for use in open-faced sandwiches or in salads. Quick-frozen shrimp packed in bags are increasing in importance. The shrimp are tender and mild in flavor. In Denmark, shrimp are cooked aboard vessel to preserve quality. In Greenland, most of catch Is processed in shore plants, where a large part is canned for export.

Top export markets for frozen shrimp are Sweden, Germany, the United Kingdom, and Switzerland. Canned-shrimp markets are Germany, United Kingdom, Sweden, Switzerland, France, and U.S. (Reg. Fish. Att., Copenhagen, Jan. 21.)

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OYSTERS REMOVED FROM RESTRICTED IMPORTS LIST

Effective Jan. 1971, oysters with or without shell, fresh, chilled, or frozen, can be imported into Denmark duty free. Until then, oysters were the only fishery product retained on Denmark's list of restricted imports.

Oysters are a festive food. The supply is small, the cost high. Limfjord oysters are in season usually from mid-Sept. until Christmas. In the past, when Limfjord oyster were not in season, limited quantities came from Holland.

Prices for smaller-size oysters, from 40-60 grams each, were about US$0.30 each. Larger oysters were $0.38-0.43 each.

Spring 1970 Planting

During spring 1970, 1.5 million new oysters were planted in Limfjord at cost of US$133,000. The harvest in the next few years will be about 200,000 oysters. Some die from winter temperatures, during transport, and for other reasons. (Reg. Fish. Att., Copenhagen, Jan. 29.)

UNITED KINGDOM

GOVERNMENT PAYS DAMAGES FOR POLLUTING RIVER

The following is a dispatch from The Times, London, which appeared in The New York Times, March 21, 1971:

A payment of £5,000 ($12,000) with costs has been made by the Ministry of Defense as compensation for damage suffered by the Freshwater Biological Association at one of its research stations. The settlement was reached out of court after more than five years of litigation.

The damage was caused by paint dumped in the Frome River in Dorset from the military camp at Bovington. This took place a year after the association established a network of experimental channels to study the behavior of salmon, trout and coarse fish as part of an ecological study of the river.

Camp Indicted

The main laboratory of the Freshwater Biological Association is on Windermere, where aquatic life in relatively calm waters is studied. The outstation in the Avon and Dorset River Authority area was an investigation into the environmental influences in fast-flowing hard water.

The contamination of the Frome has become one of the best-documented cases of the destruction caused by the dumping of pollutants into a river. The Bovington camp was indicted after a careful study involving the association's scientists and the fisheries department of the river authority.

During the investigation, innocuous salts were released into the river and their pattern of distribution plotted along the stream. Introduction of the substances from the Government establishment showed a spread identical to that of the poisonous pollutant.

Association Had to Sue

Usually a river authority can prosecute for this type of offense; but as a Government department was involved, it was left to the association to sue for damages to the value of the scientific information lost and of the disturbance caused to research.

It will probably take 14 years before it is possible to say whether the Frome has recovered completely or has fundamentally changed in character. Fourteen years was the age of the oldest fish taken from the river.

H.C. Gilson, director of the Freshwater Biological Association, expressed belief that the settlement established an important principle in making the Government pay for damage and disruption to amenities.

NORWAY'S 1970 FISHERIES WERE PROFITABLE

Norway's 1970 fishing season was the second best ever in quantity and value. The results were unexpected because forecasts had not been optimistic, and because important pelagic species were overfished and depleted. The forecasts also indicated reduced landings of cod and haddock, but this happened only with haddock.

The following listing for 1966-70 includes data for the best 3 years:

	Quantity Metric Tons	Exvessel Value US$1,000,000
1970	2,665,092	182.7
1969	2,206,452	144.9
1968	2,592,571	144.8
1967	3,036,866	166.5
1966	2,655,747	187.5

Rising prices, due to a lively export demand, produced the high gross value. The increase in quantity resulted mostly from abundant capelin landings--a record 1,307,281 metric tons, 49% of total. These were worth US$31.3 million, almost twice the 678,935 tons landed in 1969. One new contributing factor was the 90,000 tons of fish taken (herring and mackerellike species) by purse seiners off west Africa and delivered to factoryships.

Pelagic Landings

Landings in Norway of pelagic species (herring, sprat, capelin, mackerel, Norway pout, sand eel, and polar cod) were 1,992,226 tons; the figure was 1,664,881 tons in 1969. The herring fisheries based on Atlantic-Scandinavian stocks and resources produced only a fraction of landings during years when this resource was still intact.

Until 1969, mackerel was the fish landed in greatest quantity in Norway. The record year was 1967 with 868,000 tons. In 1969, 683,000 tons were landed, but only 292,708 tons were produced in 1970. Mackerel is overfished. Therefore, Norway imposed strict regulations for 1970 and will apply even stricter ones in 1971. About 400,000 tons of mackerel appear permissible annual catch from North Sea--assuming resource level is normal.

Capelin Fishery

Due mostly to capelin fishery, the fish meal and oil industry landed 1,892,000 tons from pelagic resources in 1970. This compared with 1,564,000 in 1969 and 1,947,000 tons in 1968.

The prospects of edible herring processing industry are curtailed indefinitely because raw material is lacking. In an agreement with Denmark, USSR, and Iceland, Norway has consented to limit her 1971 catch of adult Atlantic-Scandinavian herring to 1969 level of 15,000 tons, and the catch of juveniles to 70% of the same level, or 25,000 tons.

Cod Set Record

Cod landings, though down in second-half 1970, set record: 303,855 tons. These surpassed 1969 catch by 30,389 tons. The landings were 101,329 tons of spawning cod, 49,054 tons of Finnmark spring cod, and 153,472 tons "other cod."

The 1970 landings of "other cod" were also a record. These surpassed 1969's by 17,944 tons, and outweighed for first time the aggregate spawning-cod and spring-cod catch. Total landings of codlike species other than cod for human food was 176,664 tons; they were up 7,372 tons from 1969.

Other Consumer Species

The yield of other consumer species, including flatfishes, sharks, skate, ocean perch, catfish, and eel were 40,691 tons; in 1969, 45,460 tons. Landings of some of these species fell in recent years.

The reduced landings of dogfish and Greenland halibut resulted from difficulty of medium longline vessels in getting crews. There was a considerable reduction in cod catch per unit of effort in North Atlantic waters. This trend may improve gradually in 1974 or 1975, when some abundant year-classes probably will appear and influence the fishing.

Export Demand & Price Higher

Export demand and prices of fish products increased during 1970. Norwegian fishery exports probably will reach records when final figures are in. An export value of about US$280 was expected; it was US$250 million in 1969. ('Norwegian Fishing and Maritime News')

LATIN AMERICA

PERU

REPORT ON FISH MEAL PRODUCTION, EXPORTS, AND STOCKS

Peru is the world's leading producer and exporter of fish meal. The product is the largest competitor of U.S. exports of soybeans and meal.

Peru has been building stocks. On Jan. 1, 1970, these were estimated at about 725,000 short tons.

These stocks were the largest since March 31, 1968, and were expected to increase in Jan.-Mar. 1971 quarter if traditional trend prevailed.

Improved Catches

The increase reflected improved catches, which boosted estimated Oct.-Dec. 1970 fishmeal output to 725,000 short tons. This figure was 174,000 over 1969 period and largest since 1967 period.

Forecast

If Peru's 1970/71 catch continues unbroken 5-year increase, production should at least approximate preceding year's record. This could occur even with a possible decline in meal extraction.

Production could amount to 2.34 million tons, compared to 2.32 in 1969/70, if the following occurred: the estimated catch of 12 million short tons (11.7 million tons in 1969/70) and meal-extraction rate of 19.5% (19.8% in 1969/70).

This volume, plus 360,000 short tons carryover stocks on Sept. 30, 1970, would total 2.7 million tons; of total, only 40,000 would be used in Peru.

Fish Meal Exports by Quarters

Year beginning Oct. 1	Net exportable supply	Exports	Ending stocks	Exports share of exportable supply
	1,000 short tons			%
1970/71	2,660	-	-	-
1969/70	2,393	2,033	360	85.0
1968/69	2,285	2,175	110	95.2
1967/68	2,561	2,111	450	82.4

Total exportable supplies of Peruvian fish meal in 1970/71 would approximate 2,660,000 tons, a rise of nearly 270,000 tons from 1969/70 level. The increase is expected to lead to larger exports in 1970/71, unless Peru decrees further substantial increases in stocks or production costs.

MEXICO

NAVY INTENSIFIES PATROL OF NATIONAL WATERS

On Feb. 19, Admiral Bravo Carrera, Mexico's Secretary of the Navy, ordered round-the-clock surveillance of Mexico's national waters in Gulf of Mexico, Caribbean Sea, and Pacific Ocean to prevent foreign-flag vessel from entering territorial seas illegally. Special efforts to achieve this will be made in fishery zones with large schools of fish and shellfish. (Reg. Fish. Att., U.S. Emb., Mexico, Feb. 24.)

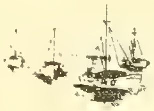
CARIBBEAN

BAHAMA ISLANDS

BAHAMAS COMMISSION 4 NEW PATROL VESSELS

With considerable fanfare, the Bahamian Government commissioned on March 5 four new patrol vessels: 'Acklins', 'Eleuretha', 'Andros', and 'San Salvador'. The vessels are manned by 45 men of the new Police Marine Division and are armed with NATO light-machine guns.

The vessels will patrol Bahamian waters (3-mile territorial sea, 3-12 mile fisheries zone) for fishing violators. They are expected to be on the lookout for spiny lobster fishermen during the lobster closed season March 16-August 31.



In dawn light off Palawan Island, mackerel are lifted by scoop-net from purse seine over side of boat to deck. They will be showered with crushed ice and shoveled into tube.

The deep tropical waters off the 7,000 Philippine Islands are rich in fish. FAO experts have helped develop purse seining.

(FAO/S. Bunnag)

ASIA

JAPAN

1970 EXPORTS OF FROZEN FISHERY PRODUCTS ROSE 10.6%

In 1970, the Japanese exported 179,000 metric tons of frozen fishery products, about 10.6% above 1969. Because of higher prices, the value of these exports increased 18.7%. The Japanese earned US$95 million in foreign currencies, $15 million more than in 1969.

Significant Changes

Most significant changes occurred in exports of tuna, swordfish, mackerel, saury, and squid. Frozen-tuna exports totaled 62,514 tons, about 3,000 tons (4%) below 1969; compared with 40% decline from 1968 to 1969, the decrease in 1970 was small.

The low rate of decline in 1970 was due to sharp increase in skipjack sales. These almost tripled 1969's and made up most losses in albacore and yellowfin shipments.

Saury & Pacific Mackerel

During 1970, saury catches were poor. Exports of frozen saury totaled 14,337 metric tons, down nearly 2,000 tons from 1969. However, value rose over US$2.1 million due to higher prices. These averaged US$667 a metric ton (US$605 a short ton), or about US$207 a ton higher than in 1969.

Pacific mackerel exports of 11,386 tons were more than double the 1969 figure. Much was exported to overseas tuna bases for use as tuna bait.

Over half the 22,361 tons of frozen squid went to Italy. ('Suisan Tsushin', Feb. 27.)

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FROZEN-TUNA IMPORTS ROSE SLIGHTLY IN 1970

In 1970, imports of tuna (mostly frozen) into Japan were about 35,000 metric tons, slightly above 1969 imports, according to Ministry of Finance. Compared with sharp gains in earlier years, this indicates that tuna imports are leveling off. Due to higher prices, the value of imports was up 27% from 1969. ('Suisan Tsushin', Feb. 24.)

Frozen Tuna & Billfish Imports

	Quantity	Value	Average Price	Major Suppliers		
	Metric Ton	US$	US$/Metric Ton	Okinawa	South Korea	Taiwan
					Metric Tons	
Tuna:						
Albacore	3,232	1,863,250	577	781	316	1,760
Yellowfin	7,180	4,448,500	619	3,359	1,595	1,657
Bluefish	342	206,270	605	29	49	104
Skipjack	5,329	1,488,170	279	683	75	2
Others1/	19,110	9,484,130	496	4,951	4,730	7,309
Total 1970	35,193	17,490,320	Not available	9,803	6,765	10,832
Total 1969	34,970	13,782,050	Not available	8,803	7,773	11,898
Billfishes 1970	16,235	7,705,360	Not available	3,132	4,106	6,215

1/Mostly big-eyed tuna.

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1971 CRAB FISHERY TO BEGIN IN BRISTOL BAY

Two Japanese crab fleets were scheduled to begin fishing in Bristol Bay in mid-March. The 'Keiko Maru' fleet (Nippon Suisan, Hokoku Suisan, and Hokuyo Suisan) consists of 14 trawlers and 2 "kawasaki" (deck-loaded, tangle-net, picking boats).

The fleet's quota is 19,200 cases (48 8-oz. cans) of king crab, and 7,460,000 tanner crabs.

JAPAN (Contd.):

The fleet has reduced its crab canning lines to 1 (from 2 in 1970). It will operate its 3 vacuum-packing machines at full capacity to increase output of frozen crab.

'Koyo Maru' Fleet

The 'Koyo Maru' fleet (Taiyo, Nichiro, and Kyokuyo) has 18 trawlers (19 in 1970) and no "kawasaki" boats (in 1970 it had 3). It will test 150-200 crab pots to replace tangle nets in the future.

The fleet's canning lines will be phased out and replaced by 3 vacuum-packing machines (only 2 in 1970). Its 1971 production quota is 18,300 cases of king crab, and 7,140,000 tanner crabs.

Tangle Nets to Pots

Although the number of Japanese crab motherships this year is the same as in the past, there is a sizable increase in trawlers, and a decrease in "kawasakis". This reveals a shift from tangle nets to pots.

Japan's crab quota for 1971 in the eastern Bering Sea is 37,500 cases of king crab (85,000 cases in 1970); tanner crab, 14.6 million (21 million in 1970). ('Suisan Keizai', Feb. 2.)

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READIES JOINT FISHING VENTURE IN NEW ZEALAND

Hokuyo Suisan, C. Itoh, and New Zealand firm Wonder Foods will establish a joint fishing and processing venture in Nelson, South Island (New Zealand) around June 1971. The company will harvest the abundant and unutilized Spanish mackerel (Scomeromorus pineusis). It will process the catch into "surimi" (minced fish meat) at a shore plant with a daily processing capacity of 3-4 tons.

Authorized capital is US$100,000: the Japanese and New Zealanders 50-50. ('Suisan Tsushin', March 3.)

NMFS Comment: The Japanese established another joint venture in New Zealand: Taimoana Fisheries Ltd., in Nov. 1967. Taiyo Fisheries Co. joined A. G. Wicclams and 16 other New Zealand investors. Taiyo's share was US$100,800 (36.3 million yen), 27.4% of total capital. Taimoana concentrates on trawling.

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MIDWATER TRAWLING FOR ALASKA POLLOCK IN BERING SEA CONSIDERED

Until 1969, Japanese "independent" trawlers fished Alaska pollock most of the year north of Unimak Island (Alaska). The peak season was July-mid-October. Frequent winter storms and spawning season between April and June caused low catches.

However, a comparison of 1970 catch with 1969's shows a decline: the same level for July; 30% less for August; and 50% less for Sept. 1970.

What's Needed To Break Even

Large trawlers cannot break even unless 23-25 metric tons of surimi (minced meat) is produced each day. To achieve this, at least 100-110 tons must be caught.

Since Sept. 1, 1970, the catch has declined from 70-80 tons/day per trawler to 30-50. On Sept. 13, 1970, only about a month before season's end, the independents moved to northwest of Pribilof Islands. The catch again increased to 100 tons per day/trawler.

Rocky Grounds

Rocky grounds pose new problems: Trawls are frequently damaged northwest of Pribilof Islands by rocky bottom (unknown on Unimak grounds), yet larger catch makes it profitable to fish there.

Alaska pollock is distributed along Aleutians and in the Gulf of Alaska, but daily catch is only 30-40 tons per trawler. Both independent trawlers and trawl fleets fish only during day. To make pollock fishing more efficient, it will be necessary to learn how to fish at night with midwater trawls. ('Minato Shimbun')

NMFS Comment: Although 1970 Alaska pollock catch in Unimak area reportedly declined from 1969, total Japanese Bering Sea pollock catch increased from 678,000 metric tons in 1969 to 1,031,000 metric tons in 1970.

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JAPAN (Contd.):

EXPORT PRICE OF BALEEN WHALE OIL TO INCREASE 30% IN DEC. '71

The Japan Whale Oil Joint Sales Co. has informed European merchants that export price of baleen whale oil produced during 25th Antarctic whaling season (beginning Dec. 12, 1971) will be increased 30% over 24th-season prices. It will be US$275 (99,000 yen) per metric ton--highest in 10 years.

The Sales Co. was established by 6 companies including Taiyo Gyogyo, Nippon Suisan, and Kyokuyo Hogei.

World Prices Increasing

The international price of baleen whale oil has been increasing because of worldwide shortage of edible oil. Another increase will strengthen Japanese whaling industry which, the Japanese say, has been stifled by international restrictions.

Baleen Whale Oil

Baleen whale oil is processed from Antarctic fin and sei whales. It differs from sperm whale oil. About 70% of Japan's baleen whale oil is exported to Europe as raw material for oils and fats, including margarine for human consumption.

Rising Prices Encourage Industry

After a 3-year interruption, the whaling companies will resume commercial production of sperm-whale oil during 25th Antarctic season. This oil is used for lubrication oils and detergents. Demand for it also has increased. Its export price is expected to exceed present $262/metric ton for North Pacific sperm-whale oil and exceed $300. ('Nihon Keizai Shimbun')

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EELS SPAWN ARTIFICIALLY

The Naiwan Fisheries Experimental Station has successfully induced the artificial spawning of eels (Anguilla japonica) after other research groups had failed.

About 5,000,000 Eggs

Five 7-, or 8-year-old females, 75-85 cm. long, and weighing 1,000-1,200 grams were used in the experiment. Since Sept. 25, 1970, they had been injected with three hormones and the pituitary extract of one rainbow trout. Three eels died one month after the injections began; of the remaining two females, one spawned about five million eggs, the other was about to spawn in Jan. 1971. ('Minato Shimbun', Jan. 10.)

* * *

SHRIMP FARMING VENTURE

The MBC Development Co., a subsidiary of Minami Nippon Broadcasting Co., is starting to farm shrimp. It has constructed two large tanks holding 2,000 metric tons of water and six 100-ton tanks close to northern edge of Kagoshima Bay.

The small tanks will be used to hatch eggs and grow young shrimp. After one month, the young shrimp will be transferred to the large tanks, each having capacity of 120,000-130,000 shrimp. Each large tank is expected to yield about 80,000 shrimp every 6 months.

The Plan

The shrimp will be fed proteins made from petrochemicals, fortified with vitamins, and impregnated with a special odor. When harvested, each shrimp is expected to be 15 centimeters (almost 6 inches) long and weigh about 20 grams (0.7 ounce). To stimulate growth, sea water pumped from the bay will be heated. If feasible, heat from hot springs will be used. Otherwise, oil may be used to raise temperature of sea water.

First Harvest Nov. 1971

MBC does not expect to know until Nov. 1971 whether the venture will succeed. The first harvest is scheduled then to be marketed at average price of 4,000 yen per kilogram (US$5.05 per lb.). Production cost per kilogram is estimated to range between 2,300 and 2,500 yen (US$2.90/lb.-$3.15/lb.).

At present, control over shrimp egg-laying activity has not been perfected. Initially, at least, egg-laden shrimp will have to be obtained. For the future, the firm plans to have the shrimp lay eggs twice a year, in April and in August.

A student of Dr. Motosakii Fujinaga, a shrimp-culture expert, is technical adviser. Also assisting is the Fishery Experimental Station of Kagoshima Prefecture. (U.S. Consulate, Tukuoka, Feb. 23.)

* * *

JAPAN (Contd.):

JAPAN'S PACIFIC SALMON CATCHES EXCEED QUOTAS, SOVIET LAGS

In 1970, in waters off Soviet Far East Coast, Japan caught 90,854 metric tons of Pacific salmon; the Soviet Union caught only 39,053 tons in her Far East rivers. This was reported by Japanese Fisheries Agency.

Japan's catch exceeded the 90,000-ton quota agreed on during Japan-Soviet Fisheries Commission negotiations in April 1970; the USSR catch fell below 40,000-ton quota. ('Yomiuri', Mar. 5, 1971.)

NMFS Comment: Table (below) shows that, except in 1968, Japanese Pacific salmon catches exceeded the quotas set at the yearly Fisheries Commission meetings. However, USSR Pacific catches fell substantially below quotas. At the 15th Annual Japan-USSR Fisheries Commission meetings in Tokyo, which began in early March 1971, the problem of the declining Pacific salmon resource was a subject of major discussion. The Soviets stressed conservation of the resource; the Japanese wanted a higher quota in 1971.

Salmon Catch in Area Regulated by Japanese-Soviet Fisheries Commission, 1966-70

	Japan		USSR	
	Catch	Quota	Catch	Quota
	Metric Tons			
1966[1]	100,782	96,000	56,223	65,000
1967[1]	144,873	108,000	78,000	83,000
1968[2]	92,012	93,000	36,191[4]	60,000
1969[1]	109,757	105,000	75,469	80,000
1970[3]	90,854	90,000	39,053	40,000

1/'Suisan Tsushin', Apr. 2, 1969.
2/ Japanese press.
3/'Yomiuri', Mar. 5, 1971.
4/40,177 ('Suisan Tsushin')

SOUTH KOREA

S. KOREANS INTERESTED IN N. PACIFIC ALASKA POLLOCK

South Korean fishermen have concentrated on high-seas tuna fishery in line with government's policy to increase earnings of foreign currencies. Now they appear to be focusing on trawl fishery in "northern waters" (Okhotsk Sea, Bering Sea, and North Pacific Ocean). They are especially interested in Alaska pollock, now in greater demand on market than salmon.

Less Money In Tuna

The reason is that Koreans, like Japanese, are making less money in tuna fishery because of declining resource, recruitment difficulties, and mercury-in-tuna problem.

Japanese fishermen have reported 5-6 Korean trawlers fishing for pollock north of Kuriles.

Trawlers for Northern Waters

Also, Japanese data show that in fiscal year 1970 (ends March 1971), about 10 small, used trawlers were sold to S. Korea for use in "northern waters." The Japanese Fisheries Agency foresees a rise in these exports. Korea already has around 20 multipurpose vessels that could be deployed in North Pacific for bottom and midwater trawling.

Japanese Uneasy

Pollock fishing by S. Korea and Soviet fleets are causing uneasiness among Japanese fishermen. They are talking about voluntarily regulating pollock fishing during summer in view of poor condition of the resource.

The Japanese also feel that the Soviets, who claim Japanese are overfishing egg-bearing pollock, will raise subject at annual meeting of Japan-USSR Fisheries Commission. ('Suisan Keizai Shimbun', Mar. 5.)

TAIWAN'S TUNA FISHERY

Taiwanese fishing firms have been hurt by declining tuna catches in the Indian and Atlantic oceans. This was reported by Yang Yung-sung, Taiwan Ocean Research Laboratory, to annual tuna conference in Shimizu, Japan, Feb. 3-5, 1971. The conference was sponsored by the Far Seas Fisheries Research Laboratory.

Yang disclosed:

The range of Taiwanese tuna fishing expanded after World War II when larger vessels were added. In 1954, the Taiwanese fished as far as Banda Sea off Indonesia; in 1956, they sailed for Indian Ocean; in 1960, for Atlantic.

The Fleet

In 1969, the tuna fleet totaled 1,039 vessels, including 396 distant-water vessels over 50 gross tons. In Taiwan, vessels under 50 tons are "inshore vessels". In 1969, 166 vessel fished in Indian Ocean, 128 in Atlantic, and 102 in Pacific. In 1970, additional vessels increased distant-water fleet to 420.

The inshore vessels, based mostly in Kaohsiung, fish primarily for yellowfin off Taiwan but also in Celebes and Banda Seas. In the latter they compete with Japanese longliners, which average $1\frac{1}{2}$ times more catch.

Peaked In 1969

Taiwan's high-seas tuna fishery peaked in 1969, then began to level off. Vessel owners are troubled by a sharp decline in Indian and Atlantic catches. They are considering switching to Pacific grounds closer to Taiwanese ports. The government reportedly agrees. The Taiwanese tuna fishery is said to be approaching its growth limits.

An economic reassessment is being made. The owners are considering cutting labor costs and installing refrigeration to improve management and reduce vessel-operating expenses.

Tuna Exporters Association

In 1970, a Tuna Exporters Association was organized. It has over half the 230 vessel owners. It is similar to National Federation of Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN).

The association's functions include: (1) study of tuna industry; (2) research on marketing and overseas fishing bases, including processing of documents for crewmen going ashore; (3) training; and (4) promoting exports.

World Bank Loans

In 1963, three 1,000-ton and thirteen 300-ton vessels were built with a World Bank loan of US$7.8 million. In 1968, a second loan of $7 million was obtained to build twenty 250-ton vessels in South Korea. In 1970, a $10-million loan was arranged with Asia Development Bank to build 40 vessels, but only 36 firms applied for loans. Over half the applications were approved. This indicates that many vessel owners, faced with management difficulties, are not building more vessels.

Industry Enthusiasm Lacking

Eighteen 160-ton tuna vessels were built in 1967, and 18 in 1968, with loans from Central American Fund (CAF). In 1969, sixteen similar-sized vessels were scheduled for construction with CAF loans but, so far, only one has been built. The government plans to continue build-up program. But lack of industry enthusiasm makes it unlikely at this time.

INDEX

☆ U.S. GOVERNMENT PRINTING OFFICE : 1971 435-341/9

BACK COVER: A gillnet is being used to harvest milkfish on a Philippines fish farm. (FAO: P. Boonserm)

The UN's Development Program (UNDP) was helping the Philippines improve brackish-water fish-culture techniques. Fish are a cheap source of protein for the islanders. FAO reports that latest feeding and fertilization practices boosted productivity to meet about 60% of needs.

Milkfish were being cultured in 345,800 acres of privately owned fish ponds.

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Fishes

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APRIL 1971

U.S.
DEPARTMENT
OF
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National
Oceanic and
Atmospheric
Administration

National
Marine
Fisheries
Service

U.S. DEPARTMENT OF COMMERCE
Maurice H. Stans, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. Robert M. White	Howard W. Pollock	John W. Townsend, Jr.
Administrator	Deputy Administrator	Associate Administrator

NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: A sling load of halibut being unloaded at a Ketchikan, Alaska, cold storage. (NMFS-Alaska photo: J.M. Olson)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).

FISHERMEN'S MEMORIAL--GLOUCESTER MASS.

Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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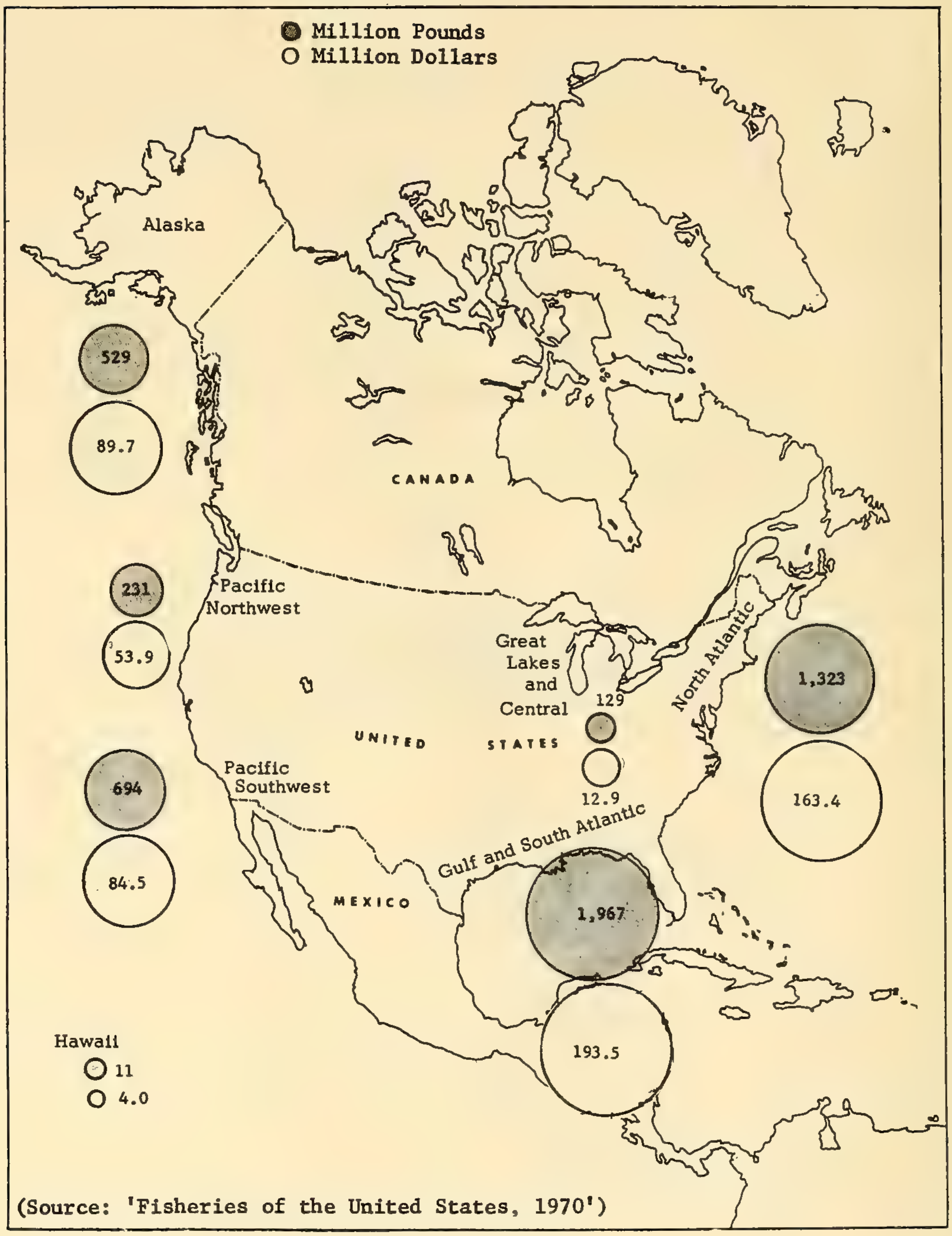
CONTENTS

VOLUME & VALUE OF CATCH BY REGIONS 1970



U.S. 1970 CATCH OF FISH & SHELLFISH WAS NEAR 5 BILLION POUNDS

In 1970, U.S. fishermen caught 4,884 million pounds of fish, shellfish, and other aquatic plants and animals. The catch was 591 million pounds, 16%, above 1969; it was the largest since 1962's all-time record 5.4 billion pounds.

The catch brought the fishermen a record income of $602 million. The figure was $83.4 million, 16%, above 1969 and 36% above 1964-68 average.

These data were reported by NMFS Division of Statistics and Market News.

UPS & DOWNS

The fishermen landed record amounts of tuna, Gulf menhaden, California anchovies, shrimp, Dungeness crabs, snow crabs, surf clam meats, northern lobsters, and spiny lobsters.

There were sharp increases in landings of Atlantic menhaden and Pacific salmon.

Also, more Atlantic flounders and blue crab were landed.

Marked declines were registered in catches of Atlantic alewives and haddock.

Somewhat lower were landings of Atlantic cod, bonito, jack mackerel, king crab, sea-scallop meats, and oyster meats.

PROCESSED FISHERY PRODUCTS

The value of U.S.-processed fishery products from domestic and imported raw material was a record $1.7 billion, 15% above 1969.

The canned pack of 46.5 million standard cases was worth $750.7 million; in 1969, $580.8 million.

There were record packs of tuna, shrimp, and animal (pet) food. Recorded, too, was larger production of salmon, crab meat, clam products, and oyster items.

Production of fish sticks and portions was a record 349.4 million pounds worth $155.3 million.

Breaded shrimp production reached 103.1 million pounds worth $109 million.

For the first time, production of industrial fishery products reached $100 million--$15.5 million over 1969.

The fast-growing fish-and-chips franchise chains kept expanding. Processors of fish and shellfish specialty dinners and other packaged fish and shellfish items passed the $460 million mark.

Exports of U.S.-produced fishery products were a record $117.7 million. Record imports exceeded $1 billion.

THE 1970 STORY

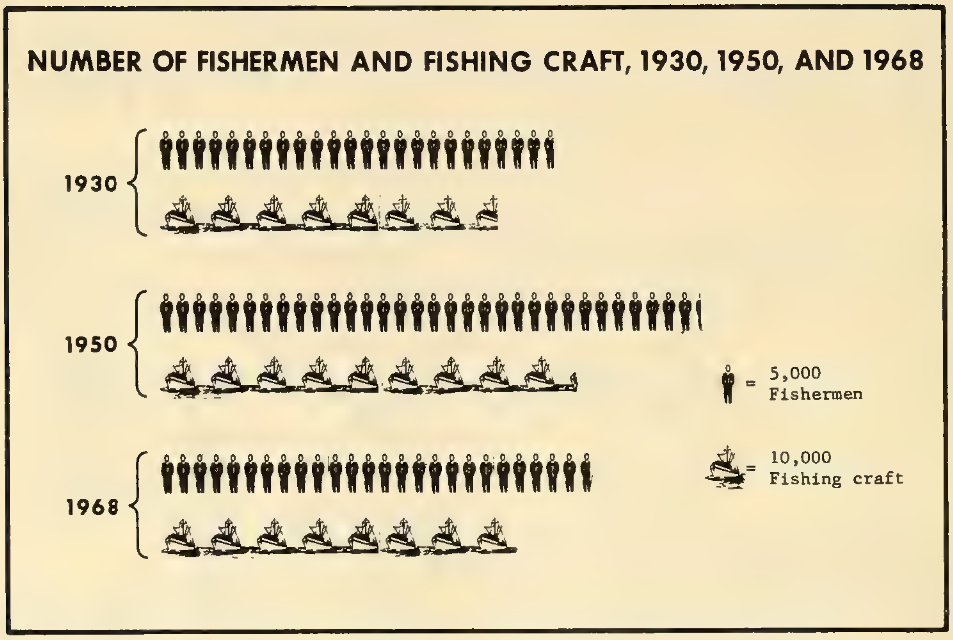
The industry picture at year end was this: pollution of the environment caused some problems; there were high inventories of some frozen products; some declines in the availability of resources resulted from natural causes and heavy fishing.

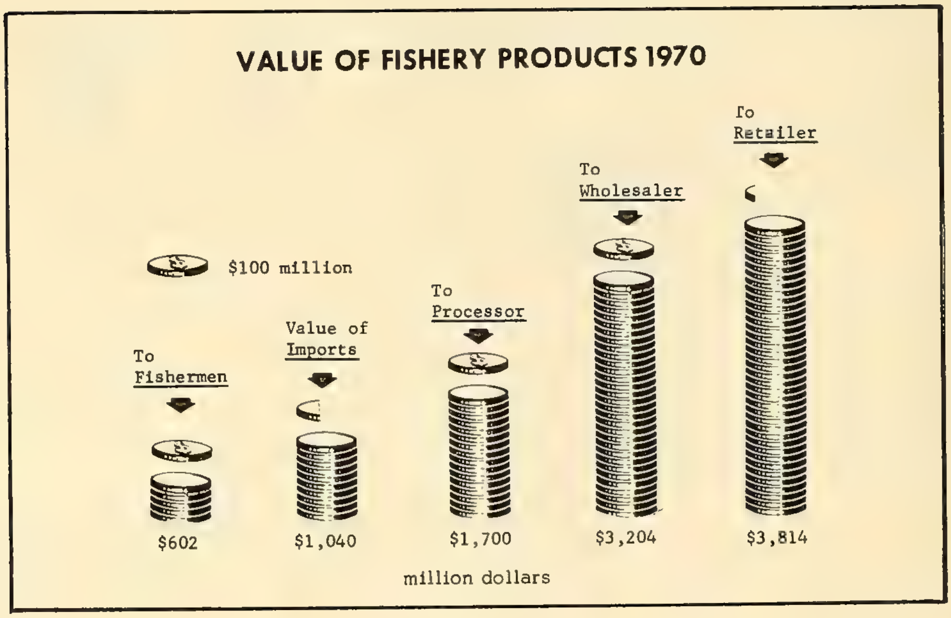
But many parts of the industry competed well with foreign fleets and were functioning at record volume.

Prices for fishery products, excepting a few, increased at all levels--exvessel, wholesale, and retail.

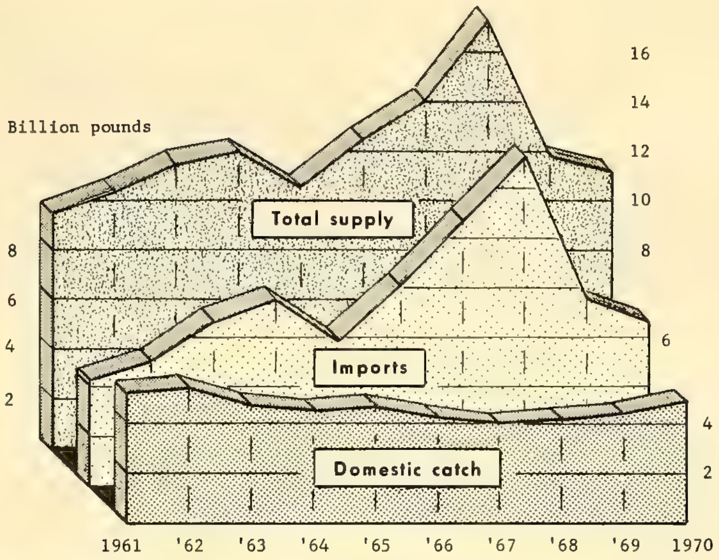
In 1970, demand for fishery products was strong. Both consumption and prices rose.

On the average, Americans ate more fishery products in 1970--11.4 pounds--than in any year since 1953.

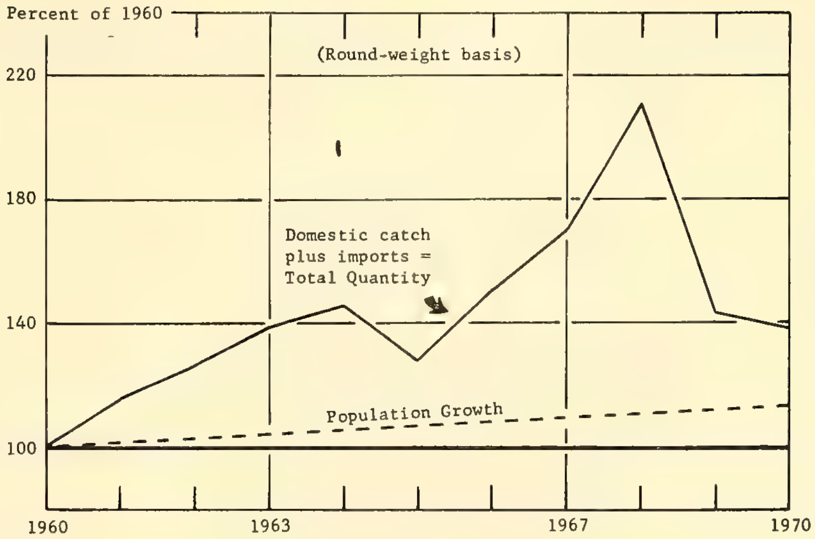

NUMBER OF FISHERMEN AND FISHING CRAFT, 1930, 1950, AND 1968
1930
1950
1968
= 5,000 Fishermen
= 10,000 Fishing craft

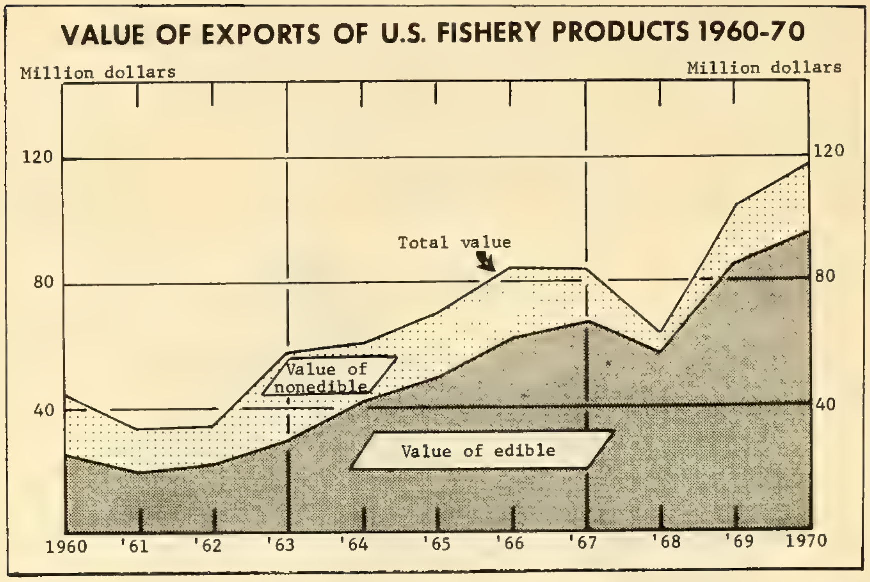

VALUE OF FISHERY PRODUCTS 1970
$100 million
To Fishermen
Value of Imports
To Processor
To Wholesaler
To Retailer
$602
$1,040
$1,700
$3,204
$3,814
million dollars

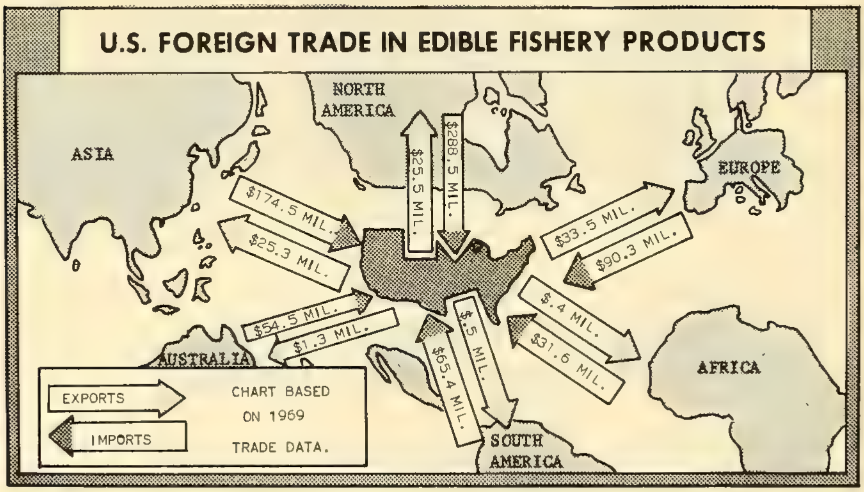
U.S. SUPPLY OF FISHERY PRODUCTS 1961-70 (Round-weight basis)

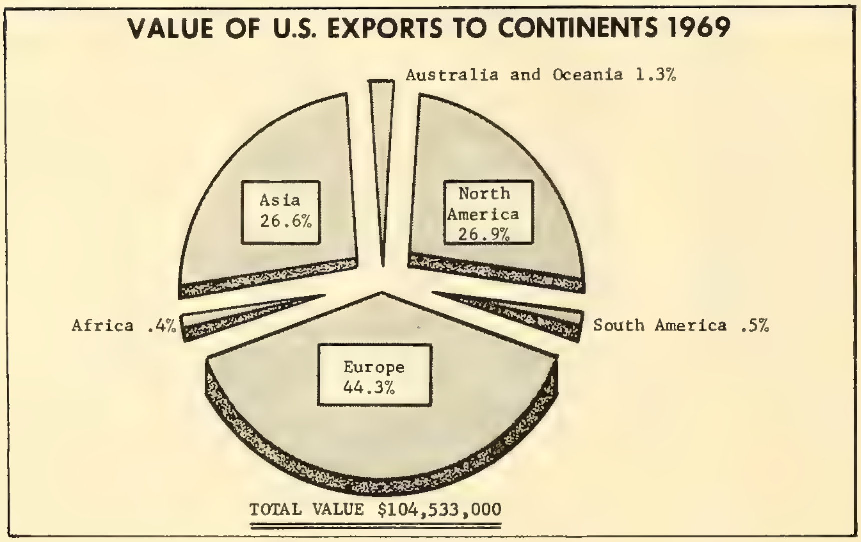


QUANTITY OF FISHERY PRODUCTS vs. POPULATION GROWTH, 1960-70




VALUE OF EXPORTS OF U.S. FISHERY PRODUCTS 1960-70
Million dollars
Million dollars
120
80
40
Total value
Value of nonedible
Value of edible
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
1970


U.S. FOREIGN TRADE IN EDIBLE FISHERY PRODUCTS
NORTH AMERICA
ASIA
EUROPE
AFRICA
AUSTRALIA
SOUTH AMERICA
$174.5 MIL.
$25.3 MIL.
$25.5 MIL.
$288.5 MIL.
$33.5 MIL.
$90.3 MIL.
$54.5 MIL.
$1.3 MIL.
$.5 MIL.
$65.4 MIL.
$.4 MIL.
$31.6 MIL.
EXPORTS
IMPORTS
CHART BASED ON 1969 TRADE DATA.


VALUE OF U.S. EXPORTS TO CONTINENTS 1969
Australia and Oceania 1.3%
Asia 26.6%
North America 26.9%
Africa .4%
South America .5%
Europe 44.3%
TOTAL VALUE $104,533,000

FISHERY PRODUCTS SITUATION

Donald R. Whitaker
NMFS Division of Current Economic Analysis

In 1970, per-capita consumption of edible fish and shellfish was 11.4 pounds--up from the 11.1 pounds in 1969. Both fresh and frozen and canned products gained 0.2 pound per capita. These gains were partially offset by a 0.1-pound drop for cured products. The net gain of 0.3 pound in 1970 was one of the largest year-to-year increases in several years. The higher consumption of fishery products was even more impressive in light of sharp gains in prices for most items.

In first-quarter 1971, retail fish prices continued their steady upward advance. They advanced 3% from previous quarter and were 12% higher than first-quarter 1970. Higher fish prices reflect not only general increase in prices and rising costs of doing business--but also the sharply higher prices processors are paying for raw fish. Higher raw-material costs account for most of the gains in consumer prices. Prices likely would be higher if marketing margins were not reduced to ease some pressure on prices.

Imported Fish Also Higher

Higher prices also are being paid for imported fish. World production of many varieties is at about maximum. However, demand in the U.S., Western and Eastern Europe, and Japan is growing. Consequently, growing demand on relatively stable and, in some cases, declining supplies is pushing prices upward.

The cost-price squeeze for many traditionally popular fish species likely will result in some substitution this year for lesser known, more abundant, and relatively cheaper varieties of fish. These substitutions are likely to occur first in the school lunch programs, fast-food chains, and in fish and chips outlets. The latter group has been faced with sharply rising menu prices.

Fresh and Frozen

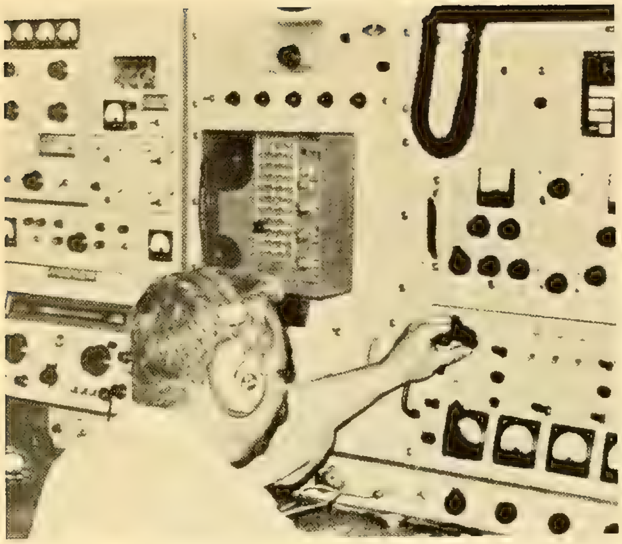
Consumption of fresh and frozen fishery products in first-quarter 1971 was probably below first-quarter 1970. Lower supplies rather than higher prices likely accounted for most of the decline. Imports were off from early 1970, and domestic production was seasonally low in the first quarter.

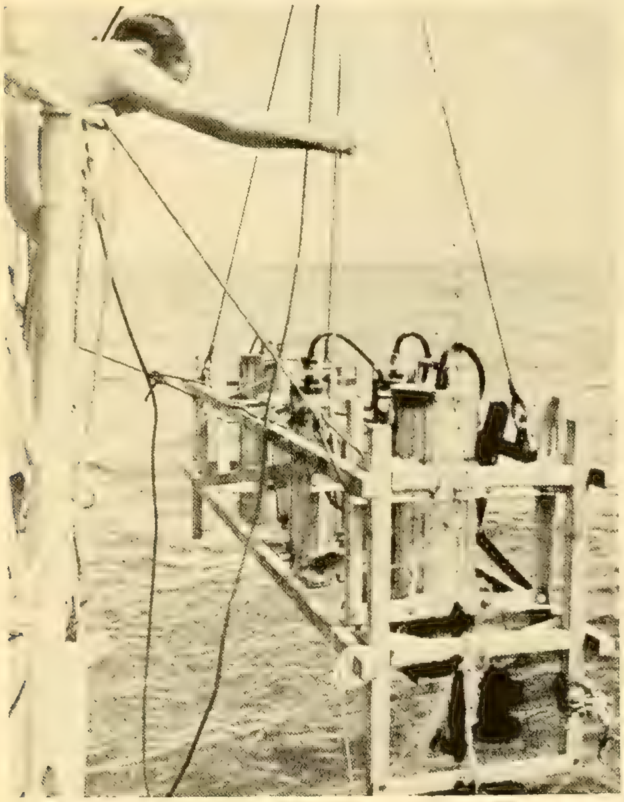
The current shortage in world fish supplies and growing demand in other countries is reflected in a nearly 30-million-pound drop in fish imports during January-February this year.

Decline in Inventories

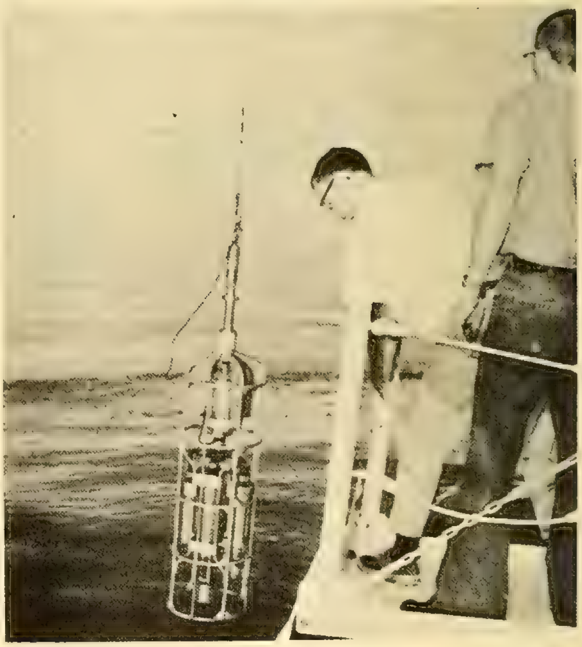
To partially compensate for declining imports, withdrawals from inventories of frozen fish have been much larger than a year ago. The decline in inventories in the first quarter was 99 million pounds compared with 76 million pounds last year. Inventories on hand at the start of the second quarter indicate few products where supplies are relatively plentiful. These include frozen salmon, flounder and ocean-perch fillets, and whiting.

The situation regarding canned fishery products is somewhat more favorable regarding supplies than for frozen products. Inventories of canned tuna, salmon, and shrimp are generally ample for trade needs. In coming months, prices of canned fish likely will be higher than a year ago, again reflecting rising costs of raw fish. Only Maine sardines are likely to be limited.





(Top) Communication center aboard NOAA National Ocean Survey's newest ship, the 'Researcher'. (Bottom) A deep-sea camera is lowered from NOAA's 'Oceanographer'.



(Top) Readying a plankton sampler. (Bottom) Multisensor package senses salinity, conductivity, temperature, and depth. It relays these measurements to electronic equipment in research ship's oceanographic laboratory.

U.S. ANNOUNCES FIRST FEDERAL PLAN FOR MARINE ENVIRONMENTAL PREDICTION

A comprehensive U.S. program in Marine Environmental Prediction (MAREP) services was announced on April 28 by the Federal Coordinator for MAREP, Dr. Robert M. White, NOAA Administrator.

Its purposes are to integrate all Federal marine environmental monitoring systems, to improve these systems, and to provide better prediction and warning services to people working in the marine environment.

MAREP's Scope

For MAREP purposes, the marine environment is the deep ocean, coastal zone, and Great Lakes. "MAREP includes analyzing and forecasting the physical, chemical, biological, and hydrodynamic states of the ocean and the overlying atmosphere, and their interaction."

Nine Federal agencies will contribute to MAREP services costing an estimated $125.4 million in FY 1971 and $145.2 million in FY 1972.

Commercial ship operators and fishermen are among the primary users of MAREP services. In the past five years, 249 U.S. flag vessels in merchant and fishing categories alone were lost because of flooding caused by storms and other severe environmental conditions. The MAREP system is designed to reduce undue exposure to these conditions by providing timely warning information.

MAREP services for civilians include many in public recreation--bathing, surfing, boating, and sport fishing. The coastal warning system, tide predictions, and radio warnings to boaters are particularly valuable.

MAREP services also are useful for defense purposes.

A basic MAREP service is the program's core. It is composed of "observational or monitoring networks, analysis and forecast centers, telecommunications services, and other facilities maintained by the Federal agency participants." This basic service provides data analyses and forecasts used by the public, government agencies, and by specialized groups.

Cost of the basic service is estimated at $67 million in FY 1971, and nearly $78.2 million in FY 1972.

5 SPECIALIZED SERVICES

Besides the basic service, there are 5 services for specialized users:

- For Maritime Navigation: In addition to NOAA's marine meteorology service, this consists primarily of Coast Guard management and operations of the International Ice Patrol, and Department of Defense sea-ice observations and forecasts in the Arctic and Antarctic.

- For Water-Pollution Control: A large part is the water-quality program of the Environmental Protection Agency (EPA), assisted by Interior's Geological Survey measurements and Transportation's Coast Guard monitoring services.

In FY 1972, plans for service improvement include expansion of monitoring service and research. This will cover monitoring hazardous materials by the Coast Guard; NOAA research in estuarine and coastal-zone physical processes and the ecology of estuarine waters; research by Atomic Energy Commission on radionuclides and their pathways to man, and on effects of waste heat from nuclear-power reactors; EPA's projects in water-quality control technology and in water-quality requirements research; and research by NASA in applying remote-sensing techniques.

• For Fishery Interests: Primarily, this is maintained by NOAA's National Marine Fisheries Service (NMFS). It includes fishery biology surveys and assessment: 1) short term to locate fish concentrations, and 2) developing long-term capability to forecast abundance of classes--and the major environmental changes that influence abundance and distribution (the ecological patterns).

A major new NMFS program--the Marine Resources Monitoring and Assessment Program (MARMAP)--will begin in FY 1972. Its initial estimated cost: $5,147,000.

• For Mineral Exploration: NOAA's Marine Minerals Technology Center is studying ways to develop techniques for predicting the probable effects of marine mining on the environment.

• For Specialized Military Application: The Department of Defense conducts many services. These serve other groups in a limited way--for example, antisubmarine warfare systems.

Fig. 1 - A Sea of Alewives in Burnham Harbor, Michigan. (Photo: Bob Langer, Chicago Sun-Times)

There have been vast die-offs of alewives in the Great Lakes in recent years. Research shows that alewives cannot tolerate excessively cold waters, although they may not die immediately. If water temperature warms rapidly in spring, the added stress of adjusting to it could trigger mass deaths.

The Great Lakes alewife is small. Adults average about $6\frac{1}{2}$ inches and weigh about 2 ounces.

→

THE GREAT LAKES:
Their Grim Problems Persist

In 1970, nearly half (48%) of fish taken out of the Great Lakes by commercial fishermen were alewives. A pound of alewives brought a fisherman about one penny. The continuing predominance of this extremely low-value fish is a continuing hardship for fishermen.

The fisheries of the Great Lakes never approached the tonnage of the major marine fisheries, but for many years they involved high-value fishes and contributed appreciably to the region's economy.

Despite this decline, the Great Lakes remain vitally important to the whole Nation. A fairly easy drive for about 25% of the population, they offer many recreational opportunities, including sport fishing. How their living resources are managed concerns everyone.

The near-shore waters and the Great Lakes and their adjacent waterfront are among the most valuable in the U.S. They are used for shoreline development, transportation, the recovery and exploitation of living and mineral resources, National defense, waste disposal, wildlife preservation, and recreation.

MAN'S HAND

The Great Lakes reflect their abuse by man. The population crowding the lakes' shores has accelerated the deterioration of water quality. The input of nutrient materials--largely nitrogen and phosphorus from man's activities--has produced eutrophication, the aging of lakes.

Lake Erie has been hit hardest, with lakes Ontario, Michigan, Huron, and Superior following in its wake. Although Lake Erie is not dead, it is far from the body of water people enjoyed 20 years ago. Southern Lake Michigan and parts of Lake Ontario show some Erie symptoms.

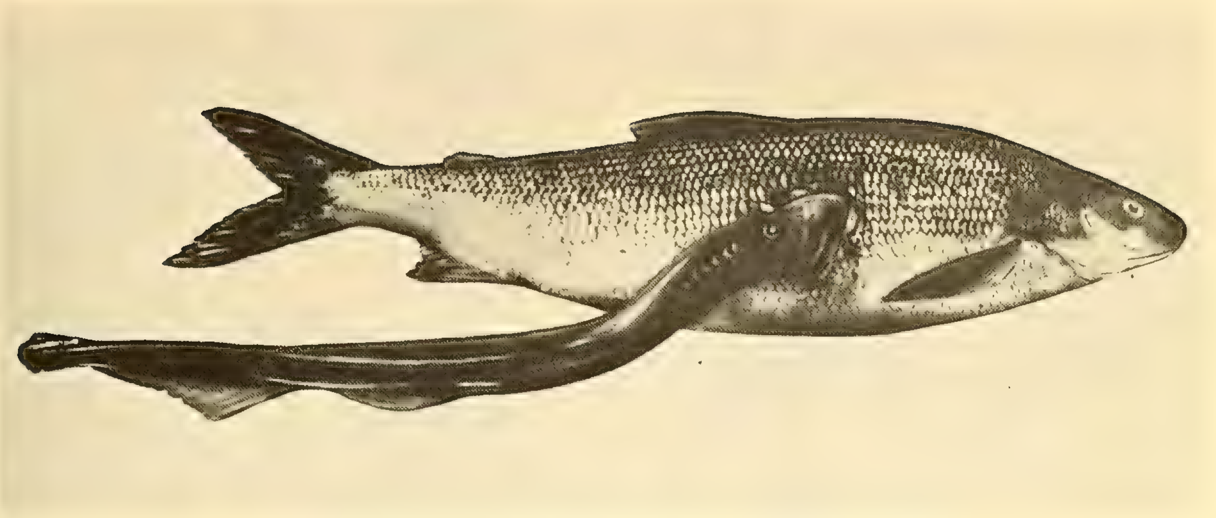


Fig. 2 - Great Lakes whitefish with sea lamprey attached to it.

The fisheries have suffered much from the deterioration of water quality. The annual catch in Lake Erie has not decreased with accelerated eutrophication, but less-desirable species have replaced more-desirable game fish. This came about because spawning and rearing areas had been contaminated or destroyed. Pollutants and sediments changed the bottom fauna, and this altered the food supply of the game fish. Only the fish that could tolerate these changed conditions--the less-desirable species--could thrive.

The radical change in the kinds of fish they caught was bad news to fishermen, and to biologists. The percentage of high-value lake trout, whitefish, blue pike, and walleye declined sharply. The only increases were in low-value species: chubs, carp, yellow perch, and alewives.

THE SEA LAMPREY

The sea lamprey played an important role in damaging the economic productivity of the Great Lakes. The lamprey had been landlocked in Lake Ontario, but the deepening of the Welland Canal between 1913 and 1918--a convenient route around Niagara Falls--gave it entry to the other Great Lakes. Lake Erie's water conditions prevented large destruction of its desirable fishes, but lakes Michigan, Superior, and Huron suffered devastation of some of their most valuable fish stocks. The lamprey nearly wiped out the lake trout and whitefish in lakes Michigan and Superior. The toll of burbot was very high. Lake trout once were worth more than $4 million a year; by the 1960s, they had dropped below $100,000.

WHY DID LAKES DECLINE?

No single reason explains the decline of the Great Lakes fisheries. Even before the sea lamprey appeared, biologists say, the fish life in the Great Lakes was "relatively thin, with fragile and unstable relations among predators and their prey." Also, the biological balance was upset dramatically "by a series of shocks: the introduction of exotic species, some from salt water and some from fresh; man's own selective fishing activities; and the flagrant pollution and misuse of the coastal zones of the Great Lakes."

The biologists say, too, that the Great Lakes are relatively new waters. Fish have not had enough time to become a stable system fully using the lakes' biological capacity--as happens in older waters of comparable size and composition.

Major causes include the physical nature of the Great Lakes, great commercial pressures, and lack of farsighted public policy.

The lamprey invasion had other significant effects. Fishermen put more pressure on the remaining valuable species--with grave effects on these populations and the number of predators. Partly as a result of this pressure, the population of another saltwater fish, long known in Lake Ontario, the alewife, exploded in lakes Huron and Michigan about 1955.

GREAT LAKES COMMERCIAL LANDINGS by State and Lake, 1970

	1,000 Lbs.
New York:	
Lake Ontario	333.0
Lake Erie	200.6
Pennsylvania:	
Lake Erie	505.5
Ohio:	
Lake Erie	8,420.0
Michigan:	
Lake Erie	420.1
Lake Huron	2,410.5
Lake Michigan	16,196.7
Lake Superior	2,141.4
Indiana:	
Lake Michigan	334.6
Illinois:	
Lake Michigan	405.2
Wisconsin:	
Lake Michigan	36,154.2
Lake Superior	1,560.7
Minnesota:	
Lake Superior	1,306.5
	70,589.0 (70,589,000 pounds)

PERCENTAGE OF 1970 U.S. CATCH BY REGIONS

Gulf States	35%
California	14%
New England & Middle Atlantic	13%
Chesapeake States	13%
Alaska	11%
	86%

The remainder: South Atlantic, Washington, Oregon, Hawaii, and inland waters. Great Lakes and Mississippi River catches combined were 129,000,000 pounds -- 3% of total U.S. catch.

The alewife was unwelcome. It could not be used for human food. When used for fishmeal, oil, and pet food, it brought very little cash to fishermen. It competed with chubs, lake herring, and shiners. But in one area, it was a plus factor: it was excellent forage fish for trout and the coho and chinook salmon introduced in recent years. The success of the latter fishes may be attributable partly to the abundance of alewives.

Deterioration of Water Quality

Vast amounts of industrial wastes and oxygen-depleting organisms fertilized by processed sewage have harmed the fishes of the Great Lakes. Soil erosion caused by the unwise development of agriculture and forested areas has damaged the nearshore environment. Herbicides and pesticides have reached dangerous levels. The relentless pressure by industry and commerce for lake-trout locations has hopelessly damaged the shoreline environment. Fish production declined sharply.

WHAT'S AHEAD FOR THE LAKES?

No one package of recommendations can end these problems. Inevitably, the land-water interface of the Great Lakes will become more congested. Industrial concentration and increasing population in the North Central States will harm the environmental quality in all Great Lakes.

But there is cause for a little optimism. Both government and public have become more conscious of the importance of coastal zones, Great Lakes, and the total American environment.

The sea lamprey's depredations have been virtually arrested. A chemical--the lampricidal agent TFM--has been used successfully in Lake Michigan and Lake Superior to destroy the lamprey during its early development. Two or three parts of TFM in a million parts of water are lethal to the larvae, while not affecting most other fish and aquatic species. Since TFM has been used, lake trout and whitefish have increased substantially and are reclaiming their rightful places in the lakes.

Canada and the U.S. joined forces in controlling the sea lamprey in Lake Superior. The situation in Lake Michigan permits rehabilitation of valuable predator species. Steelhead are doing well in several areas. Experimental plants of coho salmon in Lake Michigan foreshadow a major new sport fishery and some commercial harvest.

U.S. and State fishery researchers are defining the management problems that have to be resolved before anything close to the "most desirable balance of species and harvesting" can be achieved. This means more than "restoring" the Great Lakes fisheries. Because biological relations were so unstable in the past, it is important to select suitable species and harvesting methods.

Despite these awesome problems, scientists who have studied the Great Lakes say they can make sizable contributions to the public good.

Rehabilitating the Fisheries

The disasters of the past 2 decades have reduced the fisheries to a few men and vessels. So, ironically, it becomes easier to reestablish a commercial fishery in the Great Lakes than it would be in a marine setting. Planners recognize that while reestablishing a fishery it is necessary to balance the commercial and sport efforts and to limit the number of operating units. They believe that gear more efficient than the traditional gill and pound nets and traps would lower operating costs.

The planners recognize that the potential of Great Lakes fisheries in tonnage or value

GREAT LAKES LANDINGS

1897-1908	U.S. landings averaged 102.3 million pounds
1914-1928	85.3 million pounds
1929-1963	Average of only 75.9 million pounds. The 1963 U.S. catch was 55.8 million pounds, the lowest on record.
1966 and 1967	Sharp increase in harvest of alewives, an extremely low-valued species, boosted total. Total landings were held up by large Canadian catches.

is not large. In a list of national fishery priorities, the lakes would offer less promise than many marine fisheries. Yet they are well worth saving.

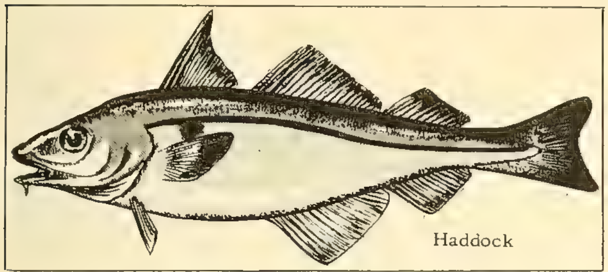
A strong national effort to control pollution now and in the coming years would permit the rehabilitation of most Great Lakes waters.

In its 1969 report, the Commission on Marine Science, Engineering and Resources emphasized the need for "full regionalization [U.S. & Canada] of Great Lakes fisheries program." The Commission stated that any plan to restore Great Lakes would be a tremendous undertaking. Present technology dealing with the freshwater environment is not oriented toward solving problems of Great Lakes magnitude--but marine science is so oriented. Marine science and technology should be used to study restoration of the Great Lakes.

Fig. 3 - Alewife Fishing Craft. (Photo: Bob Williams)

NORTH ATLANTIC HADDOCK STOCKS CONTINUE LOW

Scientists of the NMFS Woods Hole, Mass., Biological Laboratory predict that haddock stocks off New England, now under restrictive international fishery quotas, will remain at present low levels at least through 1973. The very low abundance of spawning stock is seriously reducing the probability of good reproduction.



Haddock

NMFS is responsible for wise use and conservation of marine fish resources.

The international quotas were set by the 15-member-nation International Commission for the Northwest Atlantic Fisheries (ICNAF); the U.S. is an active member.

NMFS Survey Cruises

Estimates of the haddock population size and abundance of juvenile haddock follow groundfish survey cruises aboard the laboratory's research vessel 'Albatross IV'. These have been conducted each spring and fall since 1963. Data for the 1970 cruises, and the 1971 spring survey just completed, indicate no significant change in population size during 1970--the sixth consecutive year of poor reproduction.

ICNAF Quota

The ICNAF member nations established a 12,000-ton international quota for haddock in New England waters in 1969, effective in 1970. They closed to fishing certain spawning areas during March and April of three calendar years: 1970, 1971, and 1972.

In 1970, 11,660 metric tons, 97% of 12,000-metric-ton international quota, were caught by foreign and U.S. fleets operating off New England. The U.S. fleet landed 9,864 metric tons. These domestic landings compare with a U.S. long-term, pre-1965, average of approximately 50,000 metric tons. Daily landings of haddock declined to 4,500 pounds, an 18% decrease compared to 1969 and the lowest ever observed.

Difficult Period Ahead

Stock-assessment studies have indicated strongly that the 12,000-ton-catch quota through 1971-1972 will not provide for any recovery of haddock stocks. Also, at certain low levels of abundance, there is a direct relationship between size of spawning stock and probability of a successful reproduction. Scientists at the Woods Hole laboratory are concerned that any further reduction in stock size may threaten the continued existence of the haddock species in New England waters.

THERE ARE COMMERCIAL CONCENTRATIONS OF SHRIMP IN HAWAIIAN WATERS

The research vessel Townsend Cromwell

NMFS scientists aboard the 'Townsend Cromwell' have confirmed the existence of commercial concentrations of shrimp in Pailolo Channel between the Hawaiian islands of Molokai and Maui. This was reported by Dr. Frank J. Hester, Area Director of NMFS Hawaii Area Fishery Research Center (HAFRC), when Cromwell returned home after a 47-day cruise in local waters.

Part of the cruise continued the investigations begun by HAFRC 3 years ago. At that time, commercial concentrations of opaelolo, Hawaiian red shrimp, were found in Pailolo Channel, off Molokai's northwest coast and on Penguin Bank's north edge.

One objective of the recent cruise was to check seasonal abundance of shrimp populations. The survey showed no difference in size over the 3-year period, according to fishery biologists Dr. Bruce E. Higgins and Paul J. Struhsaker.

Live specimens were taken for behavioral studies at HAFRC Kewalo Basin facility.

Best Catches

Best catches were made with a Gulf-of-Mexico-type "semi-balloon" shrimp trawl. This produced 324 pounds of shrimp during a series of five 2-hour trawl hauls.

Stern-trawling experiments with a large midwater trawl also were conducted off the Waianae coast.

Performance characteristics of the gear were checked directly by divers who observed and photographed the net in action. Depth-sensing units provided indirect observations on trawl performance in depths beyond the divers' range.

The midwater trawl is an efficient sampler of young tunas and other pelagic fishes, Higgins and Struhsaker reported.

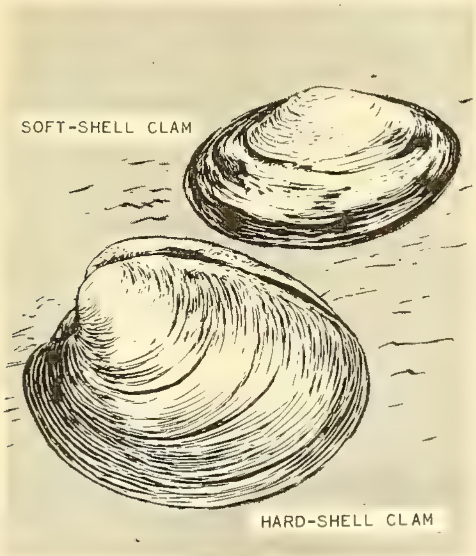
HAFRC scientists are interested especially in the distribution in local waters of the young skipjack tuna, aku, the basis of Hawaii's pole-and-line fishing industry. Assessment of the aku is a current objective of the Honolulu laboratory.

OCEAN QUAHOG BECOMES MORE IMPORTANT AS SURF & BAY CLAMS DWINDLE

Government and industry efforts have encouraged fishermen to become more interested in the ocean quahog, reports the New England Marine Resources Program.

The quahog is native to large parts of the Continental Shelf along the Atlantic Coast from Cape Hatteras, North Carolina, to the Arctic Ocean in depths of 6 to 90 fathoms.

Joseph M. Mendelsohn, research chemist, NMFS Technological Laboratory, Gloucester, Mass., says the offshore species, Arctica islandica, is the best available shellfish resource. This is because overfishing and pollution are diminishing the quahog's popular relatives--the surf and hard-shell clams.



Supplies Decreasing

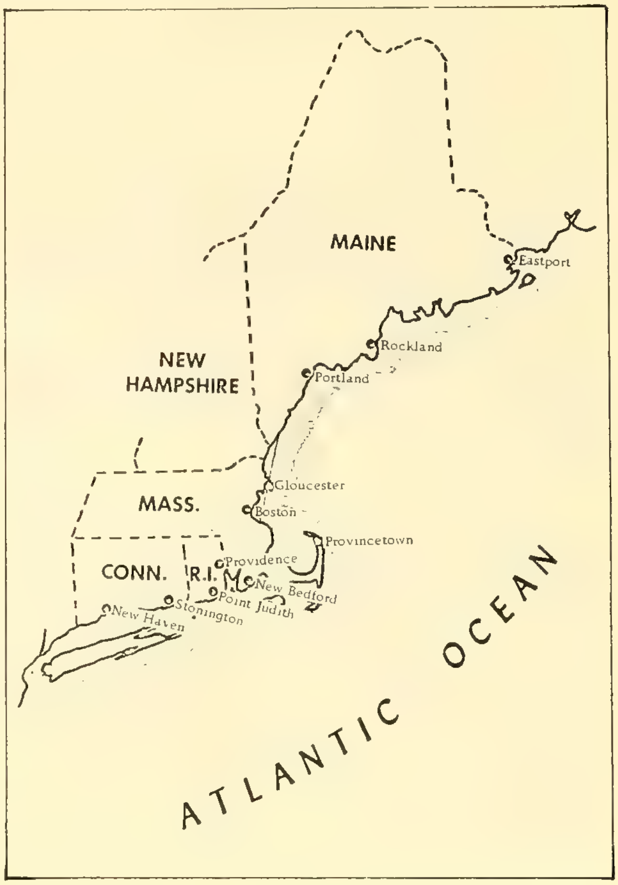
Once thought inexhaustible, resources of hard clams (Mercenaria mercenaria), sea clams (Spisula solidissima) and soft-shell clams (Mya arenaria) are dwindling rapidly; at the same time, demand is increasing constantly.

So food marketers are looking more to the ocean quahog (known too as mahogany quahog or black quahog) as a staple. If this clam is developed fully, it could lead to a steady market for fishermen year round along entire Northeast Atlantic Coast.

Dredging Ocean Quahogs

Rhode Island and nearby Stonington, Connecticut, fishermen are dredging ocean quahogs and landing them at Sakonnet Point, Point Judith, and Stonington. The quahogs are processed at Blount Seafood Corp., Warren, R.I., and at Sealord, Inc., East Greenwich.

Blount's president, Fred Richardson, regrets the disappearance of the bay quahog (hard clam) because of pollution and other reasons. He says: "At one time, Narragansett Bay was the best setting ground in the world for this hard clam, and we derived 76% of our production from this area." Blount now handles only a few thousand bushels of the bay species



Ocean quahogs. Size varies from 3 to 4 inches in length, 2.5 to 3.5 inches in height, and 1 to 1.5 inches in width. The colors range from dark mahogany to mottled black and white.

a year and processes ocean quahogs almost entirely.

Blount uses over 5,000 bushels weekly to fill demands from Camden, N.J., plant of Campbell Soups. Forty workers receive quahogs from licensed dealers, use steam to separate meat from shells, and freeze and ship to canner.

Sealord Operation

At Sealord, the operation includes processing and freezing clam and quahog products. The items include a baked stuffed-clam product, a chowder base, clam juice, and fresh and frozen quahog meat.

The firm distributes to large chain grocery stores, restaurants, and institutions. It also supplies 1,000 gallons of mahogany clams weekly in summer to an amusement center that uses only ocean quahog in its famous chowder.

Sealord operates a 72-foot boat to dredge ocean quahogs. They also receive daily the landings by 4 boat owners. The quahogs are rushed by refrigerated trucks from docks to the 10,000-sq. ft. East Greenwich plant. There they are hand-shucked or opened by steam in pressurized cookers.

Sealord uses special equipment to overcome a desanding problem peculiar to ocean quahog. The firm also uses a method to clean the shells, which have an unattractive black-skin covering. A 4-step conveyor system is used: from acid to neutralizer to cleaning bath to chlorinated treatment. The shell comes out antiseptically clean and white. Then the shell is filled with Sealord quahog stuffing.

Brayton Seafood reported that during Feb. 1971 about 15 fishing boats (4 its own) dredged daily for ocean quahogs in rich beds off Block Island to supply Rhode Island processors. The firm said demand is up because ocean quahog cost less than half bay quahog and come from clean ocean water.

Estimates of Quahog Crop

NMFS' Mendelsohn says conservative estimates of ocean quahog crop between Cape Hatteras and Canada are 100 to 150 million bushels. Based on world harvest figures, U.S. production could reach sustained annual yield of about 150,000,000 pounds of meats. NMFS is encouraging fishermen and processors to explore possibility of ocean quahog for year-round fishing and processing--particularly in Gloucester-Boston-Cape Cod-Rhode Island areas. NMFS exploratory surveys have

demonstrated that available resources would justify the ventures.

NMFS Gloucester Lab Research

Scientists of NMFS Gloucester Technological Laboratory have shown that ocean quahog can be used in many ways. It can replace bay clam in clam cakes, clam potato cakes, poultry clam stuffing, deviled clams, and Manhattan chowder. The scientists found mahogany to have a "robust" clam flavor. The medicinal or iodine flavor was found only in quahogs that came from beds where the clams feed on a specific alga. This problem can be overcome by not fishing those beds--or by "shallow-water relaying": transferring them to beds that produce clams without this undersirable flavor.

The Gloucester lab has shown that the source of this medicinal flavor is water soluble. Several washings can eliminate it.

Mahogany is harvested closed, so it is harder to shuck. Meat color varies from cream to gray. One processor has method for bleaching it to the more desirable white.

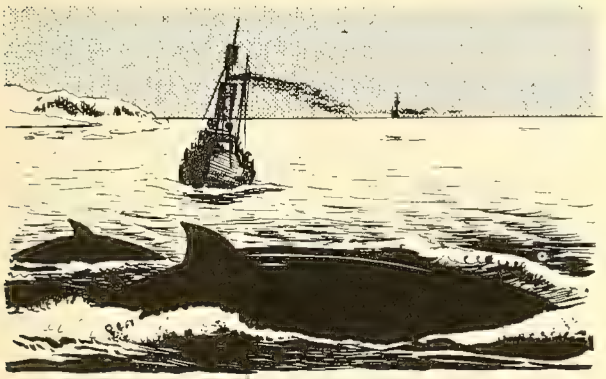
Ocean Quahog Survives Its Family

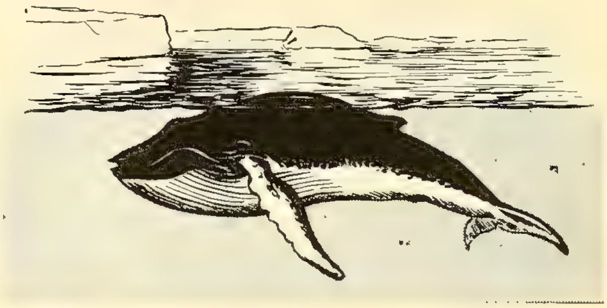
Ocean quahog is the only known surviving species of family Arctididae. This is only one of families in large group of bivalve mollusks. The latter have two opposed shells hinged together at top. At one time, the ocean quahog was thought to be a European species only.

U.S. COMMERCIAL WHALING TO END DEC. 31, 1971

On April 19, Secretary of Commerce Maurice H. Stans reaffirmed his decision to halt U. S. whaling. The date is Dec. 31, 1971.

Earlier, the Secretary of the Interior, acting under the Endangered Species Act, decided to end import of whale products after the end of 1971.





Secretary Stans said: "As Secretary of Commerce, I will do everything possible to soften the impact of this decision on the Nation's one remaining whaling company and its employees. I am directing agencies within the Department of Commerce, specifically the Economic Development Administration and the National Marine Fisheries Service, to see what can be done to alleviate hardships which may result from this action."

INDUCED MATURATION OF OVARIES & OVA IN PINK SHRIMP

Full development of successful mariculture of shrimp, Penaeus spp., will depend in large measure upon control of the entire life cycle of these animals in captivity. Gravid female shrimp collected on the spawning grounds can be induced to spawn, and their fertilized ova can be reared into shrimp of marketable size in captivity. Methods of inducing maturation of ovaries and ova in reared shrimp are now required to provide the necessary year-round control of the reproductive cycle.

Adult pink shrimp--Penaeus duorarum.

Eyestalk Removal

Scientists at the Rosentiel School of Marine and Atmospheric Science, University of Miami, Florida, have used the long-established technique of eyestalk removal as a means of inducing female pink shrimp, Penaeus duorarum Burkenroad, to mature in captivity. The eyestalks of decapod crustaceans contain glands which secrete an ovary-inhibiting hormone. Thus eyestalk removal eliminates the source of this inhibitory hormone and allows maturation to proceed.

Ripe Ovaries in 1-2 Weeks

In a research project directed by Dr. Charles W. Caillouet Jr., Associate Professor, Division of Fishery Sciences, a female pink shrimp developed ripe ovaries containing ripe ova within one to two weeks after bilateral eyestalk removal. Since the eyestalkless females matured in experiments conducted in May, July, and November 1970, Dr. Caillouet feels that maturation can be achieved year-round by eyestalk removal. Maturation was induced in females reared from ova in captivity, as well as in females collected from the spawning grounds. The project was sponsored by Armour and Company and United Brands Company.

Important First Step

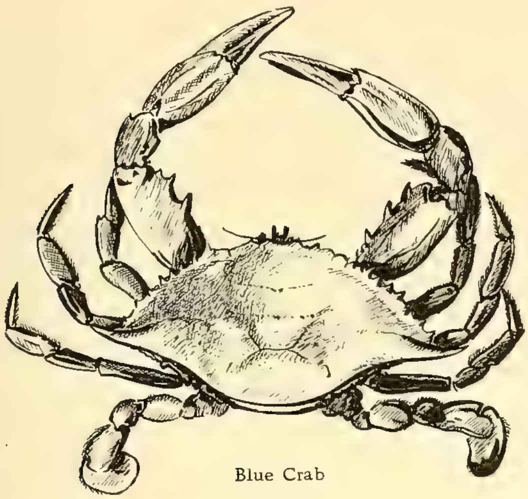
This work represents an important first step toward producing multiple generations of pink shrimp in captivity on a controlled basis. The methods should be applicable as well to other species of Penaeus presently being cultured in captivity.

Dr. Caillouet was assisted by Gary L. Beardsley, Research Assistant, and Nicholas Chitty, Graduate Assistant.

--Dr. C. P. Idyll, Chairman,
Division of Fishery Sciences,
Rosenstiel School of Marine and
Atmospheric Science,
University of Miami,
Miami, Florida 33149

BLUE CRABS ARE SUSCEPTIBLE TO POLLUTION OF SHORELINE

Catches of blue crabs, important to commercial and sport fishermen, may be reduced by industrial and agricultural pollution of the shoreline environment.



Blue Crab

Studies by Eugene Jaworski, Texas A&M University's Department of Geography, have established that blue crabs migrate from one environment within an estuary to another to meet the physiological requirements of their different life cycles.

Jaworski explains: "The low salinity area in the upper reaches of an estuary is a vital one because maturation of the crabs takes place here. This shoreline area is the one most susceptible to pollution."

For a year, he made periodic trips with crab fishermen and collected data from the Barataria Estuary in Louisiana, which is southwest of New Orleans and west of the Mississippi River.

Fishermen were the best source of information on locations of the crabs because fishing patterns reflect the seasonal distribution of commercial-size crab populations. A tagging system was not practical because of the blue crab's molting pattern.

Jaworski identified 3 main subhabitats of the blue crab: the areas where it matures, winters, and spawns.

The Seasons

During winter, crabbing is most successful in the lower, highly saline waters of the estuary. As spring approaches, crab-fishing areas become larger. Water temperatures begin to rise, and adult males and immature juveniles migrate toward lower salinity waters of upper estuary. Pregnant females begin to spawn in the lower estuary and adjacent marine area.

By late March, "sponge crabs," females in process of extruding eggs (protected by law) cause fishermen to abandon high salinity waters of lower estuary.

"The crab population reaches its widest distribution during summer months, and upper estuarine waters yield the highest catch," Jaworski explains.

"Soft-shell" crabs are most numerous in this shallow, shoreline environment. Caught while molting, these crabs are a seafood delicacy.

As fall begins, molting and spawning stop. Females mate after final molting and migrate again toward tidal inlet entrances. Small juvenile blue crabs are in lower estuary and along Gulf. Adult males and large juveniles stay near shoreline until decreasing water temperatures force them back toward lower reaches.

By mid-December, crabbing in the upper estuary ends, and the winter season begins.

VIMS IMPROVES METHODS OF PRODUCING 'CULTCH-FREE' SPAT

A major obstacle to developing seed oysters in commercial hatcheries at reasonable cost has been the expensive washing and handling of bulky oyster and clam shells used as natural cultch. The development of "cultch-free" seed oysters may facilitate a hatchery operation that eliminates the use of shells for cultch and costly washing and handling. Scientists of the Virginia Institute of Marine Science (VIMS) are now concentrating on improving methods for separating spat from artificial substrate at a very early age--and then growing them in trays and tanks without cultch until they are large enough to be planted on beds.

Oysters pass through a free-swimming larval stage for about two weeks. After that, most larval oysters settle to the bottom, extend their fleshy feet, and crawl about seeking suitable substrate to attach themselves.

Producing Cultch-Free Spat

The first successful method developed at VIMS for producing cultch-free spat is based on the natural sequence of changes that begins when the well-developed larval oyster (eyed larva) attaches to a shell or artificial substrate. The method is accomplished when oyster larvae change their structure to become juvenile oysters (spat). The first period when the newly set oyster can be removed easily from the cultch is while the spat is developing gills, and after the food and velum have begun to disappear; it is before sufficient new shell is produced for permanent attachment.

Two VIMS Methods

VIMS has developed one method for growing the spat in relatively clear estuarine areas after removal from substrate. A second method grows them in areas with muddy waters.

In the first method, it is important to remove oyster spat before they become attached permanently. While massive setting of eyed larvae is taking place in the setting trays, a strong stream of river water is applied to a commercial plastic sheet (Mylar) on the bottom surface of the setting tray at 1-to 2-hour intervals. This yields cultch-free spat.

Microscopic examination shows that the water pressure tears the temporary organic matrix attachment, which releases the spat before any new shell can be deposited, but after metamorphosis has begun. Then these free spat are put into containers with a glassy Mylar bottom. If some spat reattach to the Mylar, they can be removed easily by bending the Mylar over a roller. Heavy sets have been avoided on natural cultch, but they are advantageous for free spat production. It is desirable to limit the setting surface.

Second Method

A second VIMS method manipulates newly set oyster spat where siltation and fouling are serious problems. Removal of newly set spat from Mylar sheet is delayed 19 to 21 days. A new setting tray, frames, and tank were designed to manipulate efficiently the setting, growth, and removal of spat. The Mylar sheets on which larvae spat have set are mounted in frames that hold the sheets vertically in the tank to minimize the accumulation of silt and trash around the oyster spat. Untreated river water is circulated to the holding frames, then spills over a ledge into an auxiliary tank.

Study Nursery Techniques

VIMS also is investigating development of nursery techniques or methods of growing cultch-free spat to sizes resistant to predators, such as crabs, fish, drills, and starfish. Unlike clams, oyster spat are unable to reattach or dig into substratum, so they are washed away easily or are covered by silt. The challenge VIMS accepts now is to grow cultch-free spat in trays or ponds to a size suitable for planting in oyster beds.

SALTWATER FARM-RAISED SALMON MARKETING PROGRAM IS BEING TESTED

Salmon have long been an important food resource in the Pacific Northwest. To supplement natural production, Federal and State agencies operate freshwater hatcheries, where young salmon are reared until ready to migrate downstream to the sea. Rearing salmon to maturity in saltwater pens would extend control over the entire life cycle. This would permit biologists to breed them selectively for characteristics best suited to market demand. Such research is being conducted by the NMFS Aquacultural Experiment Station in Manchester, Washington.

The Procedure

Newly hatched fry are placed in circular tanks of fiberglass or steel lined with polyethylene sheeting. The tanks are supplied with fresh and salt water; the salinity is adjusted. When the fish are able to live in saltwater, they are transferred to floating pens. The fish are fed with moist pellets, a wet, high-protein feed. Also, shrimp meal can be added to their diet for 5 to 6 weeks to control the redness of their flesh. This feed is supplemented by naturally occurring plankton and other small forms of sea life carried in with the tidal currents.

Under such ideal conditions, salmon grow much faster then they do in the natural pattern of extended freshwater life. They are ready for market as trout-sized fish in 18 months or less.

Test-Marketing Underway

The NMFS Marketing specialists are test-marketing these salmon to get public reaction. They are distributing samples to major retailers, wholesalers, and restaurant operators in selected metropolitan cities to determine their interest. They are gathering information on market form desired--dressed head-on, dressed head-off, or boned, the size or sizes preferred, the price acceptable to buyers, and the flesh color preferred (degree of redness).

A Firm's 1972 Plans

In January 1972, Ocean Systems, Inc., a division of Union Carbide, operating under a NOAA Sea Grant, will have 400,000 salmon

The Testing Area

available for market. These fish are being raised with NMFS technical assistance and will be available fresh and/or frozen throughout the year. If this pilot program is successful, the company will raise about 2.5 million fish to be marketed starting January 1973.

Salmon Shipped

Approximately 300 fish have been shipped to Boston, New York, Baltimore, Washington, Tampa, and Minneapolis for distribution by the NMFS Marketing staff to selected potential buyers. Already, the staff has commitments for the sale of about 300,000 pounds. The retail chains are requesting fresh salmon 12 to 16 ounces in the round and/or dressed. The restaurants and distributors that service restaurants are asking for 14 to 16 ounces dressed, and 12 to 14 ounces boned, both fresh and frozen. In July and August, 1,000 more fish will be test-marketed in several restaurants to obtain consumer reaction.

Gus Morel, Acting Chief, Division of Marketing Services, reports that the Seattle seafood firms, and wholesale, restaurant, and retail merchandisers contacted throughout the U.S. are enthusiastic about the salmon they have seen. They are eager to try selling the salmon when they become available in January 1972.

SEA GRANT FOR SALMON CULTURE

The success of NMFS salmon-culture experiments has encouraged a private firm to adapt and expand the system for possible commercial production.

With a $100,000 NOAA Sea Grant, Ocean Systems, Inc., based in Reston, Va., will try to show the feasibility of a commercial-sized pilot operation to raise pan-size salmon from egg to market size in Puget Sound, Wash., enclosures.

NMFS Biological Laboratory, Seattle, Wash., will assist.

The $100,000 will be matched by the firm, plus nearly $160,000 more. The firm's principal investigator for the project is Jon Lindberg.

The project began Nov. 1, 1970, because of the Pacific salmon's spawning cycle and the need to get the best results with summertime cultivation. The firm has bought and installed incubators and hatched 670,000 coho salmon eggs. These were obtained from the Washington State Department of Fisheries. Also, about 400,000 chinook salmon fry of a selected strain were gotten from Dr. Lauren Donaldson, University of Washington. Coho and chinook fry are now in fresh-water ponds.

In late May, the fry will be transferred to floating net pens in the open water of Puget Sound. They will be fed a prepared fish food until they weigh about one-half pound, and then be harvested.

Market conditions will determine harvest time and fish size.

Many Pioneered

Many people prepared the way for this project. Washington State has had salmon hatcheries since 1895. Today, about 30 hatcheries continuously rear 15,000,000 chinook, coho, and chum salmon for release at normal migrating time into salt-water pasturage.

Oregon State University research has shown that fry of several Pacific salmon species may be adapted to sea water before their normal time to exploit the high efficiency of feed conversion in salt-water rearing.

NMFS Seattle laboratories conducted salmon-culturing experiments to reduce pen cultivation to practice. The labs developed a relatively quick method of rearing salmon intensively. Floating pens in flowing tidal water ended many of the problems that obstructed earlier work. These experiments inspired the Ocean Systems project.

3-Phased Project

Ocean Systems project has 3 phases:

Salmon now are being cultured for market;

With aid of NMFS Division of Marketing, there will be test marketing and cost evaluation of the cultured salmon;

Federal, state, and local agencies will be provided information and guidance on aquaculture principles, compatibility with other water uses, and possible changes of fishery laws to permit commercial salmon culture. The results will be made public and may be used.

Coho or Silver Salmon

The coho or silver salmon was chosen "primarily for its resistance to disease, voracious feeding, history in culture experiments, and value as a food fish. The chinook, another highly desirable species, was included to obtain comparative results."

Salmon have several advantages for culture: They are much sought as food, grow rapidly, and their hatchery technology is perhaps most highly developed of any marine fish. Also, Puget Sound's abundant marine resources make possible intensive fish culture, using much clean flowing salt water.

STRAIT OF GEORGIA BOASTS ANNUAL 'PEA SOUP' OF PHYTOPLANKTON

During May, the Strait of Georgia between Vancouver Island and British Columbia explodes into a vast "pea soup" bloom of phytoplankton (microscopic algae). It happens every spring, when mountain snows melt and wash rich nutrients into the icy ocean waters. A month-long expedition sponsored by the National Science Foundation and the Foundation for Ocean Research was on hand for the blooming this May.

Its work is essential to continuing studies on fat metabolism in marine ecological systems by the Scripps Institution of Oceanography, University of California, San Diego.

Marine food-chain research also is planned to seek better understanding of who eats whom and why in the ocean environment.

Copepods End Hibernation

About the time the algae bloom, copepods--tiny, shrimplike marine organisms--end their winter hibernation in the cold, dark waters near the bottom of British Columbia inlets. They rise to within 30 feet of the surface and begin grazing on phytoplankton.

Copepods have interested Dr. A. A. Benson, director of Scripps's Physiological Research Laboratory (and biologist Richard Lee) for the last 3 years. Copepods are the predominant marine animals small enough to consume microscopic algae in the ocean. They are thought to be the first animal link in marine-food chain.

Insects of the Sea

These "insects of the sea" change the extremely polyunsaturated algae fat into polyunsaturated liquid waxes. They store these in oil sacs to be used as reserve energy during periods of starvation.

Up to 50% of the dry body weight of Vancouver copepods is stored liquid wax. This

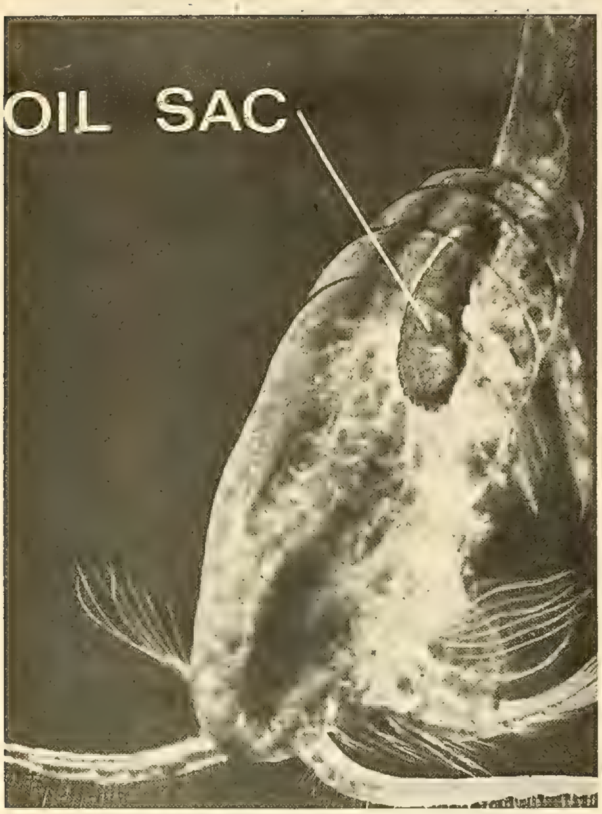


Fig. 1 - Enlarged photo of $\frac{1}{8}$th-inch marine copepod 'Calamus', "insect of the sea." Oil sac is toward rear of its tiny body. Wax is used for energy storage and food supply during periods of starvation and hibernation in long winters. Wax is made from oils of algae that it eats (darker area below sac).

makes them some of the world's waxiest copepods.

While copepods are swimming to the surface, where they eat freshly bloomed algae, baby chum and sockeye salmon are swimming downstream from their river birth places on their way to begin life in the open ocean. About 4 or 5 inches long, the salmon fry eat only wax-rich copepods.

Coincidence of Copepods + Salmon

Dr. Benson's group hopes to discover what triggers this coincidence--the return of copepod to the ocean's surface at the moment the small, hungry salmon arrive from the rivers.

Because the young salmon eat only copepods, their whole metabolic system is geared to digest large amounts of wax. They offer scientists the most specialized example of wax digestion.

Sardines, anchovies, and herring also feed, though not exclusively, on copepods—but these species are difficult to catch in the open ocean. Vast numbers of bay chum and sockeye salmon are easily available when they swim through the Strait of Georgia in May.

Second Animal Link

Salmon fry are the second animal link in the marine food chain. They digest copepod wax and turn it into a fatty alcohol; they convert this into fatty acids. Fatty acids are the common fats that human beings eat.

However, to perform this chemical conversion, fatty aldehyde must be involved in an intermediate stage. So far, no trace has been found in salmon. The scientists plan to look for it in the blood samples from young feeding salmon.

Fatty aldehydes also are a source of mystery in human metabolism. They occur as major components of human heart muscle and brain, but their existence has never been explained.

How they get there or what they do are mysteries. Dr. Benson thinks salmon may provide a clue.

Analyzing Copepod Waxes

The scientists are studying other things. To understand better the marine food chain, they are analyzing copepod waxes suspected of having been derived from different types of algae populations. They are comparing wax composition in copepod with fat composition in fishes that feed actively on copepod wax.

The researchers are collecting samples from the 95-foot ocean research vessel 'Dolphin'. They are collecting wax-filled copepods to isolate enough wax for experiments on animal nutrition and on the potential uses of wax in making varnish and plastics.

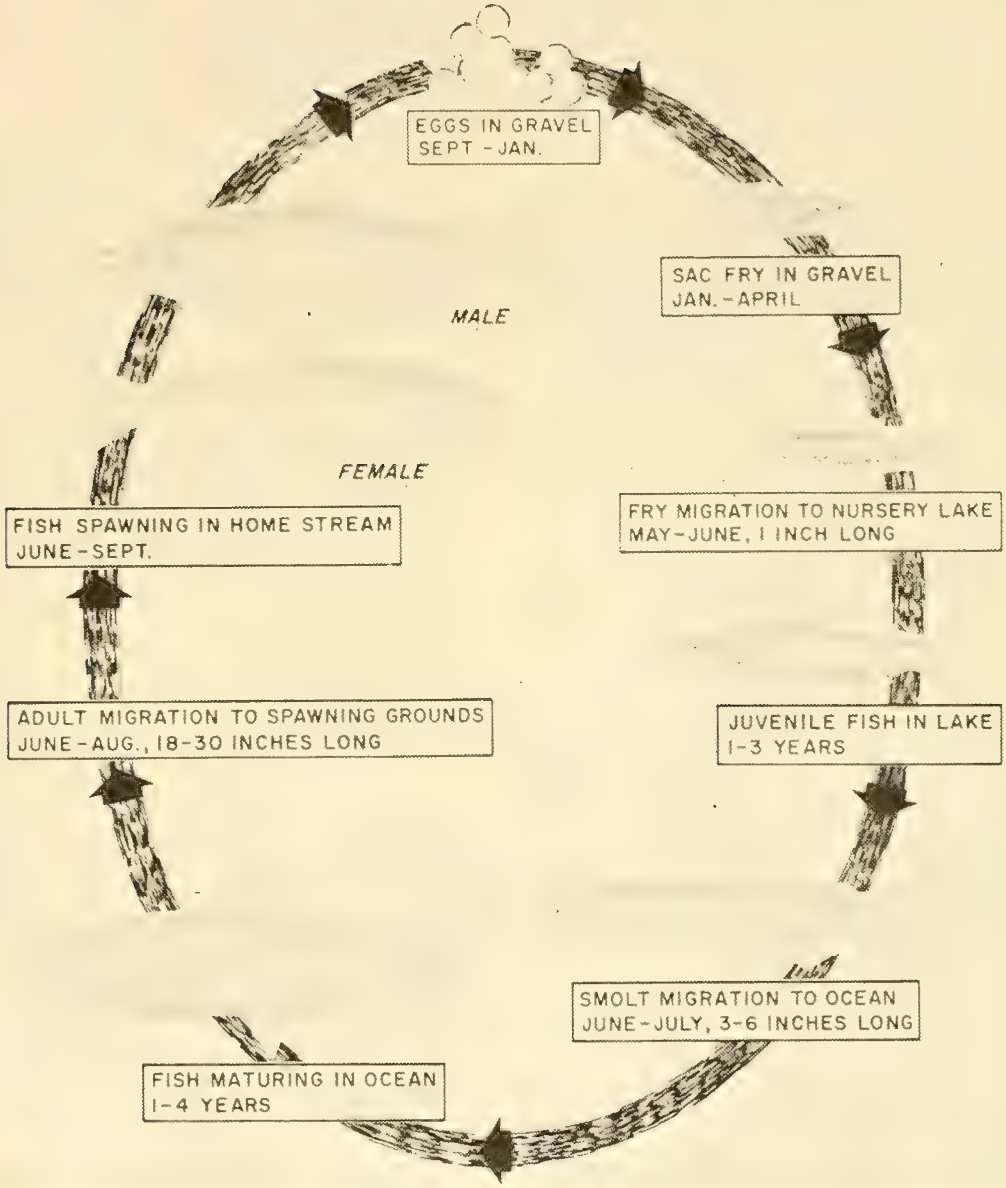


Fig. 2 - Life cycle of ths sockeye salmon.

POOR YELLOWFIN-TUNA FISHING OFF W. AFRICA IN 1970

A preliminary examination of length-frequencies of yellowfin tuna caught off West Africa by the U.S. and Canadian purse-seine fleet has revealed significant differences in year-class strength. The work was done by Dr. W. Lenarz, NMFS Fishery-Oceanography Center, La Jolla, Calif.

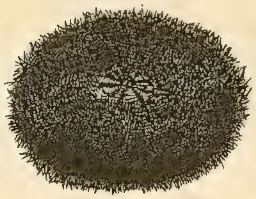
Very few fish of the 1968 year-class were caught in 1969 compared to contributions of the same age in other years. The apparent failure of the 1968 year-class was evident too in 1970. Data from the surface fisheries of France and French-speaking nations also show that 1968 year-class was below normal in 1969. Data for 1970 are not yet available.

Poor Fishing in 1970

Normally, the 1968 year-class would have yielded a significant part of 1970 landings. The apparent failure of 1968 year-class may be an important cause of relatively poor fishing by U.S. fleet in African waters during 1970.

Data from 1970 U.S. fishery indicated that 1969 year-class is much stronger than 1968 year-class. The high variance in year-class strength of Atlantic yellowfin contrasts with relatively stable recruitment in eastern tropical Pacific.

SEA-URCHIN GONADS TO APPEAR IN U.S. 'SUSHI' RESTAURANTS



Sea urchin

Lovers of seafoods will find an unusual one on the menus of U.S. 'sushi' restaurants: sea-urchin gonads. S. Kato of NMFS La Jolla has demonstrated to workers at a California firm how to process gonads for human consumption.

An abalone diver collected about 500 urchins and delivered them to the company. One hundred urchins yielded 11 pounds of gonads--after dark-colored gonads and broken pieces were discarded. The gonads were delivered fresh to a Los Angeles market, which shipped some to Chicago and New York.

800-1000 Lbs./Month

Initial monthly production will be about 800-1000 pounds. One diver and a helper in a boat can pick 1600-2000 urchins a day. Four men in a second boat will crack the sea-urchin shells and remove the gonads. Final cleaning, packing, and freezing will be done by 11 workers in the plant. California's Farm Labor Board helped find workers from ranks of unemployed field workers.

Entire Output for U.S.

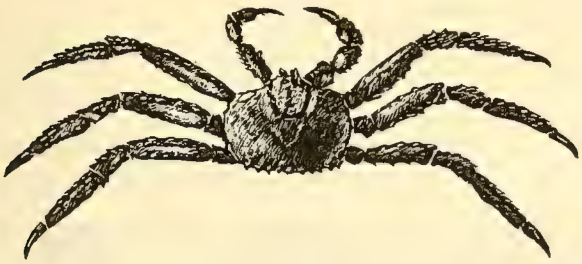
The entire production will be used in U. S., mainly in specialized 'sushi' restaurants in New York, Chicago, Los Angeles, and other cities. When production increases, the gonads will be exported to Japan. The fishery will begin when the company receives special packing trays.

Kato also demonstrated the processing methods to a San Diego fish dealer. Japanese importers are slated to arrive in San Diego in May 1971 to sample product and to negotiate price and delivery schedule.

ALASKA'S KING CRAB RESTRICTIONS RELAXED

Some restrictions in king crabbing were relaxed by the Alaska Board of Fish and Game, reported the 'Kodiak Mirror' on May 8.

The most significant was a change in the legal size of crab that may be taken along Alaskan Peninsula, in Aleutian Islands and the Bering Sea. A uniform $6\frac{1}{2}$-inch minimum king crab now may be taken instead of the 7-inch minimum previously required in most locations.



A closed season for king crabbing in Bering Sea also was established: April 1 through May 31.

Bering Sea

In Bering Sea fishery, shared with Japanese and Soviet fleets, the minimum-size crab permitted domestic fishermen will be $6\frac{1}{4}$ inches during March, June, July, September, and October. This size is a treaty provision. The months during which smaller crab are allowed are those when the foreign fleets are normally operating in Bering Sea.

The change to the smaller crab responds to the requests by king-crab operators during the past few years.

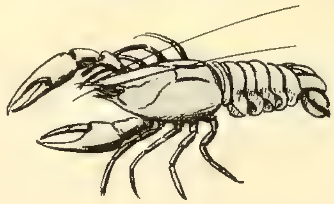
More Crab Pots

Another relaxation was an increase in crab pots permitted from Cook Inlet westward into Aleutians. The limit was raised from 60 to 75.

The previous limit in the eastern Aleutians remains 75 pots; in the western part of the chain, it is 90. There is no pot limit in Bering Sea.

CALIFORNIA CRAYFISH TO FINLAND FOR SCIENTIFIC PURPOSES

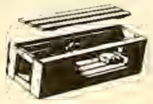
The California Fish and Game Commission approved on April 30 the capture and transport to Finland for scientific purposes of 100,000 Lake Tahoe crayfish.



Finland stated that the fish will be tested to see whether they can survive and reproduce in Finnish waters, where crayfish disease is rampant.

Swedish Success

During 1967-1970, Lake Tahoe crayfish were shipped to Sweden for experimental restocking purposes. The experiments were successful. The crayfish were highly resistant to the infections that have nearly wiped out native lake crayfish.



NEW ENGLAND MARINE INDUSTRY MUST IMPROVE TO PROSPER, STUDY SAYS

If New England's marine industries hope to win future U.S. & world markets and allay growing public anxiety about the environment, they will have to improve their operations and originate new products and services. These are the central points of a study by the New England Aquarium of Boston, Mass., and the New England Marine Resources Information Program. W. R. Patterson of the Aquarium directed survey.

The survey focused on marine company. It excluded small fishing firms, local fish-processing and retailing firms, marine retailers, and marina operators. These form a sizable number of workers in marine-related business.

The report is a preliminary analysis of questionnaires sent to 405 regional companies; 131 (32.4%) usable forms were returned.

Patterson estimates there are 345 to 415 such firms in New England employing 110,000 to 130,000 persons. Estimates of sales for these companies ranged from a half-billion dollars to five billion.

FINDINGS

The study revealed that 43.6% of companies answering questionnaire had sales of under one million dollars a year; 2.9% sold over 200 million. Of the sales, 90.25% was in U.S. (38% of this in New England); 9.75% in world markets. Sixty-one of 131 companies reported some international sales.

The companies expected a 90% average increase in world sales in the next 5 years. They cited expanding foreign markets, especially Japan and Europe, need for their products, and their unique services. About 25% of firms have or expect problems because of foreign competition, import duties, and shipping costs.

Industry Predominantly Onshore

The New England marine industry is a predominantly onshore manufacturing operation. Only 10% of companies operate beyond coastline. Manufacturing-fabrication is 47% of total. The manufacturing is mainly electrical or mechanical in the basic technology.

The smaller, more highly specialized firms employing fewer than 50 persons had highest percentage (33%) of technically trained workers. On average, about 10% of all the employes are technically trained.

Sales are mainly to industrial-commercial and government-military customers.

Domestic Sales

The firms are optimistic about domestic sales growth in next 5 years: from 55% (transportation) to 163% (coastal-zone management). The reports cautions that latter sample was probably too small for accurate conclusion.

Companies in electronics-instrumentation, biological equipment-products-services, and research technology-design expect sales improvement.

Questionnnaire Comments

The study evaluates business practices: "The current corporate policies are attempting to follow the guidelines of the past and have not undergone critical reorganization for the next decade."

The report states: "Marine scientists must redirect their research, reestablish their thinking on the usefulness of the sea, and approach all investigations in a more socially related way."

Marine Environment Dominant Theme

Preservation and protection of marine environment will be dominant theme in marine development in next decade, the report predicts. Government aid may fall below industry expectations, so the latter will have to reorganize policies to meet this eventuality.

Monitoring and controlling pollution sources will require low-priced equipment and improved biological technology.

Every technological device should be used to find "cheapest way to harvest the premium biological marine foodstuffs."

New ways must be found to use the coastal zone for recreation--and new recreational equipment to satisfy expected demand.

State and local governments will seek more control over the environment. The electronic data-processing part of the marine industry will expand with this movement. New ways should be found to gather the information sought.

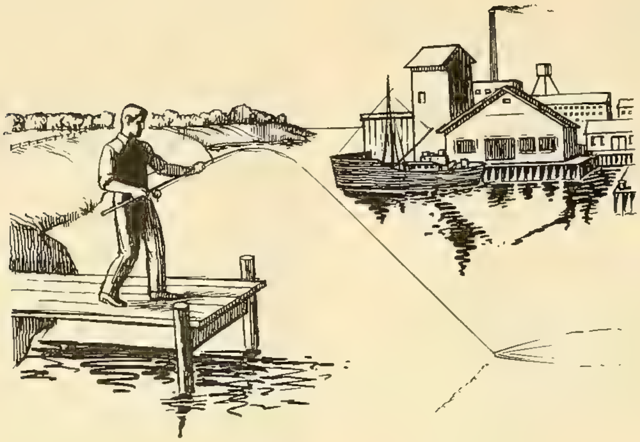
Marine transport will be used more. This will create demands for hardware and equipment. Better methods to load and unload ships--and to prevent harbor and coastal pollution--will be needed.

Man's use of marine environment will spur greater attention to biological studies of the effects. This will change "thrust of research and scientific development to more socially oriented programs."

Marine industry must contribute to development of new methods for coastal zone multiuse as state and U.S. land-use policies improve.

BOSTON HARBOR (Mass. Port Authority Photo)

MORE FISHING AND HUNTING LICENSES SOLD



In 1970, fishermen and hunters spent more than $192 million for licenses, tags, permits, and stamps--an increase of $9.3 million over 1969. This was reported by the Fish and Wildlife Service (FWS), U.S. Department of the Interior.

The number of fishing-license holders was a record 24,434,680--358,532 above 1969.

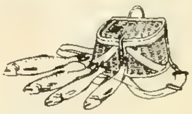
Fishermen spent $90,864,154 for licenses--$3.4 million above 1969.

Not Accurate Indicators

The agency cautioned that license sales are not accurate indicators of actual numbers because: (1) in several states, one sportsman may purchase separate licenses, stamps, permits, or tags for different fish species; (2) most states do not require persons above or below certain ages to buy licenses; (3) most coastal states do not require licenses for salt-water fishing; and (4) some persons fish in more than one state and are counted more than once.

Money For Conservation & Management

State fish and game departments certify the number of paid hunting and fishing license holders to the Fish and Wildlife Service. FWS uses the data--plus the size of State fishing and/or hunting areas--to determine how much money it will add to State funds for fish and wildlife conservation and management.



OCEANOGRAPHY

AUTOMATED DATA-GATHERING SYSTEMS BEING INSTALLED ON NOAA CRAFT

NOAA's National Ocean Survey (NOS) has acted to speed the acquisition of hydrographic survey data and the production of nautical charts. It is installing automated data-acquisition systems on 3 ships and 6 of their auxiliary 25-foot launches at a cost of $497,200.

The agency produces about 2,700,000 nautical charts a year for commercial shipping, small-craft operators, and the military.

Will Speed Charts

The new system was designed by Survey personnel. It will reduce appreciably the two years now required to produce a new chart from beginning of hydrographic surveying to publication of chart.

It should improve effectiveness of data gathering aboard hydrographic survey vessels because it will eliminate human errors. These now occur during manual conversion of data to digital format for later computer processing and chart compilation ashore.

The new systems also will provide for automatic control of vessels and launches over predetermined straight line courses as they conduct hydrographic surveys. This will increase still more the overall effectiveness and efficiency of the data-gathering process.

Significant Advance

The new systems are as much an advance over present manual system as use of echo sounder (sonar) was over methods used in early days of hydrographic surveying. At that time, the lead line was used to determine water depths and bottom characteristics. The development of echo sounding and exact electronic navigational control systems during the past 30 years has significantly improved hydrographic surveying.

NOAA EXPEDITION SEEKS CLUES TO AFRICA-NORTH AMERICA SPLIT

The first complete investigation of an entire ocean's sea floor is being carried out by NOAA scientists aboard NOAA's 'Discoverer'. The 10-week study in April, May, and June centers on a 250-mile-wide, 3,500-mile-long corridor from Cape Hatteras, N.C., to Cap Blanc, Mauritania, in northwest Africa.

The project is directed by NOAA's Atlantic Oceanographic and Meteorological Laboratories (AOML) in Miami, Fla., and by the National Ocean Survey.

The Cape Hatteras-Cap Blanc corridor was selected because many scientists believe it is the path North America and Africa took when they divided and began drifting apart 200 million years ago.

What Scientists Will Do

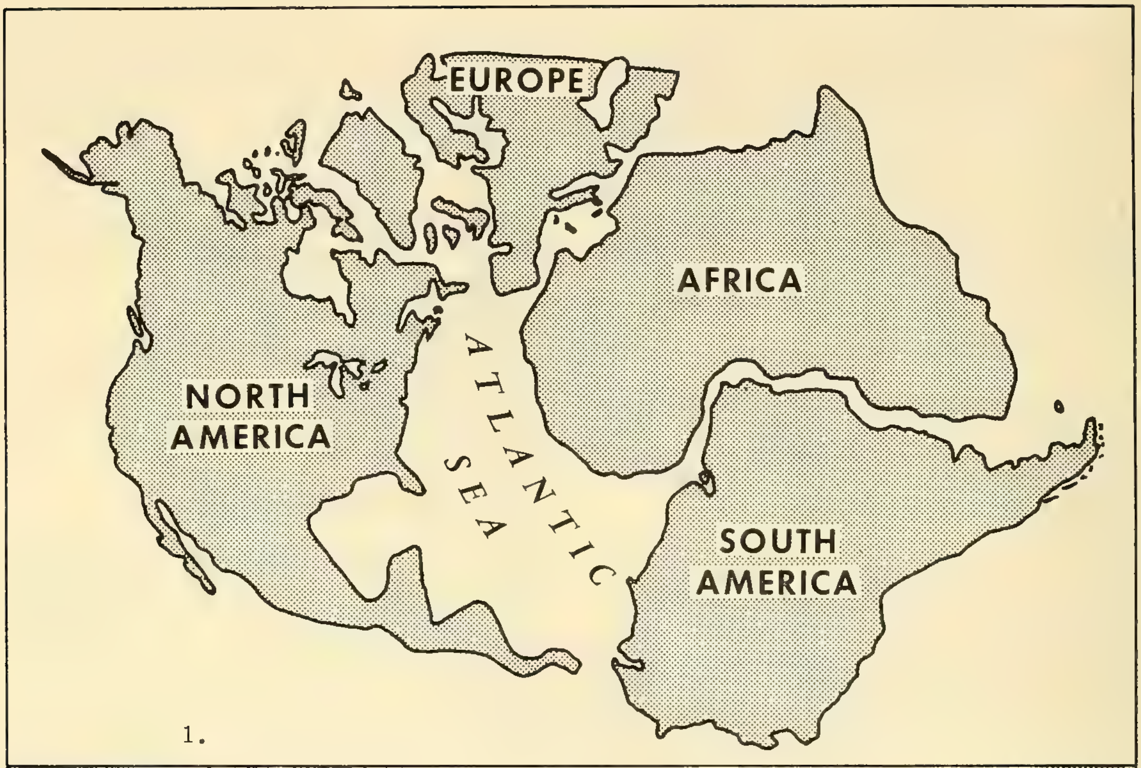
The NOAA scientists will use the Discoverer's electronic equipment to probe the bottom and subbottom along corridor to determine the structure and to sample the rocks forming the ocean bottom.

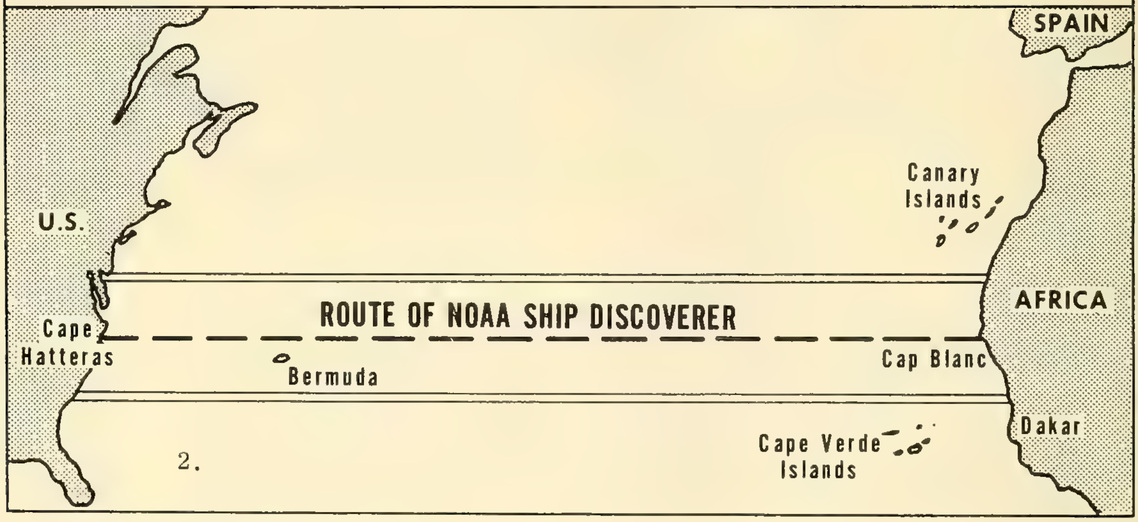
They will investigate the way the continents separated. They also will study sea bottom for evidence of potential mineral resources. Dr. Peter Rona, the project's chief scientist, recently discovered huge domes off northwest Africa on the ocean bottom within the same corridor. These resemble the oil-producing salt domes of the U.S. gulf coast and have "immense potential significance for petroleum industry."

Samples of Ocean Bottom

Coring devices will retrieve samples of the ocean bottom's layered sediments. Dredges will raise samples of rocks and sediments from chasm-like fractures of the floor. The ship's deep-sea camera may photograph the ocean bottom.

Electronic instruments will record data on the earth's magnetic and gravity fields. These data are useful in interpreting the ocean floor's geological history, evaluating the potential for oil and mineral resources, and for a better understanding of active earthquake zones in the North Atlantic Ocean.





1. Interpretive sketch of North Atlantic Ocean as it may have existed 200 million years ago after continents surrounding it split up and began to drift apart.

2. The 250-mile-wide area across which Cape Hatteras and Cap Blanc may have drifted apart. It is route of NOAA ship Discoverer as she seeks answers to mystery. The ship will spend 10 weeks this spring probing sea bottom between the two continents.

SATELLITE WILL SPEED TRANSMISSION OF WATER DATA

An earth-orbiting satellite will relay streamflow, water quality, and groundwater-level data from monitoring stations to a central records center, according to a plan disclosed in April by the U.S. Geological Survey, Department of the Interior.

A Survey hydrologist, Richard W. Paulson, described an experiment involving 20 hydrologic stations in the Delaware River basin. From these, radio-telemetered data would be picked up and relayed by NASA's first experimental earth-resources technological satellite, ERTS-A, planned for launching in early 1972.

The Plan

Paulson said: "By using the satellite as a data relay system, we believe that we can reduce the time lag between data collection and dissemination to less than 12 hours--compared to present systems with a lag of two weeks to two months." He added that "many of the water data network stations in the Delaware basin are located in relatively remote regions, and have no telemetry hook-up, and the data records are generally collected by hand at weekly intervals."

One data-collection station also will have a landline telemetry hook-up, as well as transmitting via satellite, "thus helping to provide an accurate cross-check of water resource information."

Message Every 90 or 180 Seconds

Paulson explained: "A brief water data message will be broadcast every 90 or 180 seconds from the various monitoring stations in the basin. When the satellite passes within 1,400 miles of the basin the satellite will pick up the data messages from the stations and transmit them to an 'acquisition site' at Greenbelt, Maryland, about every 12 hours.

"This will provide water resources management agencies and officials data at frequent intervals--particularly important at times of water supply or pollution problems.

"As water resources agencies develop the means for managing river basins, the results of this experiment are expected to demonstrate the relative merits of satellite relay of data versus conventional data transmission and to provide a basis for development of operational satellite relay of hydrologic data."

NAVIGATIONAL HAZARDS ALONG NEW JERSEY COAST BEING SURVEYED

NOAA's National Ocean Survey (NOS) began a 6-month search along the New Jersey coast in late April for over 60 reported navigational hazards in the intracoastal waterway between Little Egg Inlet and Cape May. Purpose is to update nautical charts.

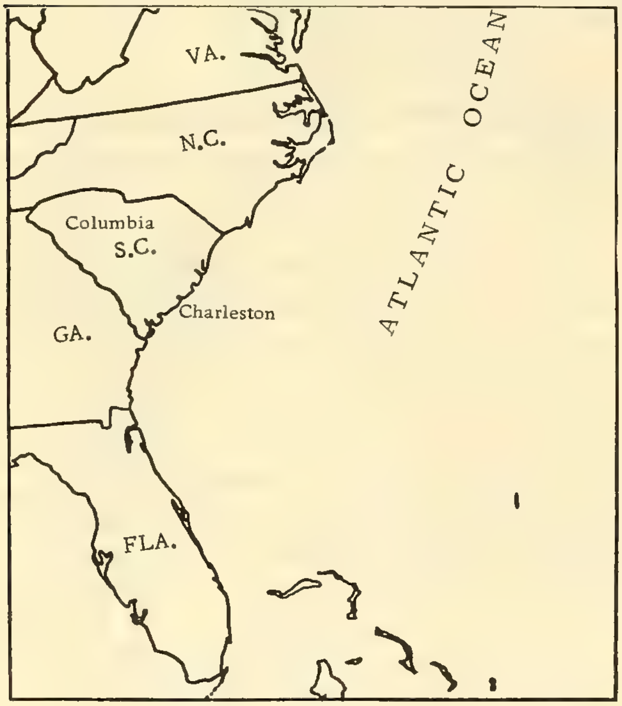
The survey team is looking for wrecks, piles, pipes, rocks, shoals, and other obstructions in harbors, rivers, creeks, and channels.

Hazards will be reported to NOS chart division for inclusion in 'Notice to Mariners' and for correction of 'Small Craft Chart 826-SC' and other charts. The report will cover changes made by dredging, waterfront construction, and natural causes.

STUDY EFFECTS OF DREDGED CHARLESTON HARBOR SEDIMENTS ON MARINE LIFE

A one-year cooperative study on the effects of dredged harbor sediments on the flora and fauna of Charleston Harbor, South Carolina, will be initiated by the NMFS Center for Estuarine and Menhaden Research, Beaufort, N.C., and the Belle W. Baruch Coastal Research Institute, University of South Carolina, Columbia, S.C. The 2 groups were awarded a one-year contract by the U.S. Army Corps of Engineers.

Large amounts of silt and sediment are dredged from Charleston Harbor each year to maintain ship channels. The dredgers face a problem of where to dispose of these sediments. Present plans call for deepening the harbor channels to accommodate large ships. This will increase temporarily the amount of spoil to be disposed. The problem is aggravated by the fact that Charleston Harbor has been polluted for many years by municipal, industrial, and agricultural wastes. These wastes may include concentrations of heavy metals, pesticides, oil, and other organic and inorganic salts that could affect marine and estuarine organisms.



Study Goals

The 1-year study will attempt to determine what effect the resuspension of the sediment, and its associated toxic materials, will have on certain prominent planktonic marine organisms and the young of certain fish. Plankton and larval fish were chosen because they are fundamentally important to the survival of a disturbed ecosystem--and because these stages are most sensitive to environmental disruption. Data from this study could help evaluate any proposed environmental alternation of the waters in Charleston and neighboring localities.

R.T. Whiteleather, Director, NMFS Southeast Region, announced that Dr. F. John Vernberg, Baruch Institute, and Donald E. Hoss, NMFS Laboratory, will direct the study.

A NEW SHIPBOARD NAVIGATION AID

A new shipboard navigation aid processes Loran-C radio signals to provide a heading angle and range to the ship's destination; at the same time, it displays velocity and any cross-track error. The Coast Guard Loran Assist Device (COGLAD) system was developed by The Johns Hopkins Applied Physics Laboratory (APL). In recent tests aboard Coast Guard Cutter 'Acacia' on Lake Huron, APL scientists were able to approach within 10 yards of an ice-concealed buoy using the device.

How It Works

To maintain a true course, the helmsman keeps a needle centered on a meter while a digital display reads out yards to the destination. Relevant navigation information is presented graphically on meters at the helm, and on the COGLAD system in the chart

Helmsman's Navigator

This black box, about the size of a telephone base, tells helmsman aboard a ship exactly where to go and when he has arrived. Top needle in meter indicates if he is going in right direction; bottom needle (both appear as one in photo) lets him know his cross-track error and how much in yards. Oblong window (left) tells distance to destination--and coordinates are fed to Hewlett Packard electronic calculator, which has been programmed to compute navigation figures from Loran-C signals. A "O" comes up in window when craft has reached target point set in calculator.

At right is interface box, which operates Loran signal receiver (not shown) and calculator. The interface unit reads out cross-track error and speed, along-track distance and ground velocity. Knob is for adjusting unit on its stand at helm.

room. Meanwhile, a plotter marks ship's course with a pen on standard navigation chart in real time as vessel proceeds.

Key to System

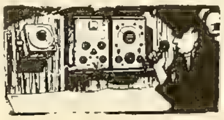
An interface box is the key to shipboard system. It accepts the Loran-C radio navigation signals from a receiver and preprocesses them for programmed computations by a Hewlett-Packard 9100B Electronic Calculator. The interface unit, without modifications, is compact enough to fit directly on top of calculator.

From microsecond time differences in signals received from 3 widely separated Loran transmitters, the programmable calculator determines accurate position of vessel on a rectangular coordinate latitude and longitude grid. This is done instead of adhering to the Loran geometry, which exhibits position on hyperbolic time difference lines.

Once the coordinates of a destination are fed to COGLAD system, the programmable calculator recomputes automatically the heading angle, along-track distance, along-track velocity, cross-track error, and cross-track velocity every $2\frac{1}{2}$ seconds. The plotter marking ship's course on map in real time also is commanded by calculator after being fed the scale of map used and a reference point from which to operate.

System's Advantages

The system is particularly useful in setting out buoys and returning to them, and also can be used to navigate rivers and channels. The Loran-based system offers special advantages in search-and-rescue missions. The recue ship can be directed speedily to any point, and the system can aid the ship to steer a precise pattern for optimum coverage of a search area.



NOAA WILL MAP FLOOD-PRONE ATLANTIC AND GULF COASTAL AREAS

NOAA has announced a storm-evacuation mapping program for flood-prone areas along the Atlantic and Gulf coasts where hurricanes may strike. At times, storms, particularly hurricanes in the Gulf of Mexico and along Atlantic coast, cause extensive tidal flooding of low-lying coastal regions.

The National Weather Service watches these storms very closely. It tries to predict the height of the storm tide. It issues warnings of possible flooding as soon as possible.

Series of Useful Maps

NOAA's National Ocean Survey will prepare maps showing emergency evacuation routes, areas subject to flooding, and elevations that might be "safety islands" for storm evacuees. The maps will show areas of flooding at various heights of storm tide.

The first map will cover the shore area from Mobile, Ala., to New Orleans, La. It is scheduled to be completed June 1.

1,400 DEAD IN 1970 BOATING ACCIDENTS

More than 1,400 persons lost their lives in boating accidents during 1970, reports the annual "Boating Statistics" of the U. S. Coast Guard (USCG). The Commandant of the Coast Guard stated that despite the best efforts of U. S. and State boating safety agencies, and organizations and individuals throughout the U.S., the number of deaths is still rising.

The Commandant added: "We feel that regulations which will be developed after passage of the Federal Boat Safety Act of 1971, now before Congress, will greatly aid us in reversing this trend."

Property Damage Up

Property damage increased by almost two million dollars. Injuries, however, decreased to 780 from 1,004 in 1969. The reported number of accidents also decreased from 4,067 in 1969 to 3,803.

There was an increase of more than 250,000 numbered boats--to 5,128,345--over 1969.

FISHERY-ADVISORY INFORMATION AVAILABLE TO TROPICAL PACIFIC TUNA FLEET VIA RADIO FACSIMILE BROADCAST

R. Michael Laurs

Fishery-advisory information is being transmitted to the tropical Pacific tuna fleet via radio facsimile (FAX) broadcast by the NMFS Fishery-Oceanography Center at La Jolla, California. Two FAX charts containing oceanographic and weather information tailored to fishermen's needs are being transmitted daily (except weekends) to vessels on the fishing grounds in the eastern tropical Pacific by NMFS-licensed radio station WWD at 2300 GMT on frequency 17294.9 kHz.

Sea-state information including swell direction and height, wind-wave height and, once each week, a 7-day sea-surface temperature analysis, is given on one chart (Fig. 1).

A second chart provides information on direction and speed of surface winds, location and direction of movement of tropical storms, location of areas of squalls and other inclement weather conditions, and location of the Intertropical Convergence Zone (Fig. 2).

Within the next month or so, a weekly analysis of thermocline depth will be included on the charts. Eventually, the location of ocean-surface temperature fronts indicated by infrared temperature measurements made by orbiting satellites and received by the Automatic Picture Transmission (APT) installation at the Fishery-Oceanography Center will be added to the charts. The geographical coverage of the charts is from the American west coast to 140° W between latitudes 30° N and 5° S.

The FAX charts are based on data received at the Fishery-Oceanography Center from many sources. These include: merchant ship marine weather and sea-surface temperature observations, which appear on Service 0 circuit 8275, the APT installation at the Fishery-Oceanography Center, Navy Fleet Numerical Weather Central at Monterey, National Weather Service storm warning bulletins and other products, and cooperating fishing vessels.

The fishery-advisory service is being performed on an experimental basis as a means of obtaining valuable environmental data from fishing vessels--and to provide fishermen with information that may assist them in making tactical fishing decisions. The environmental data collected by fishermen are necessary for use in the development of fishery-forecasting techniques and methods for tropical tunas now underway at the Fishery-Oceanography Center. The environmental data are also passed on to the Navy Fleet Numerical Weather Center in Monterey, California, and the National Weather Service for use in their programs.

The Fishery-Oceanography Center is providing FAX recording equipment to cooperating fishermen with the agreement that fishermen make and transmit ashore at least one XBT-BATHY, with probes provided by the Navy Fleet Numerical Weather Central or synoptic marine weather observation per day while on the fishing grounds. FAX equipment has been installed aboard 13 modern purse seiners during the 1971 tuna fishing season, and more installations are planned.

The author is an Oceanographer, National Marine Fisheries Service, Fishery-Oceanography Center, 8604 La Jolla Shores Drive, P.O. Box 271, La Jolla, California 92037.

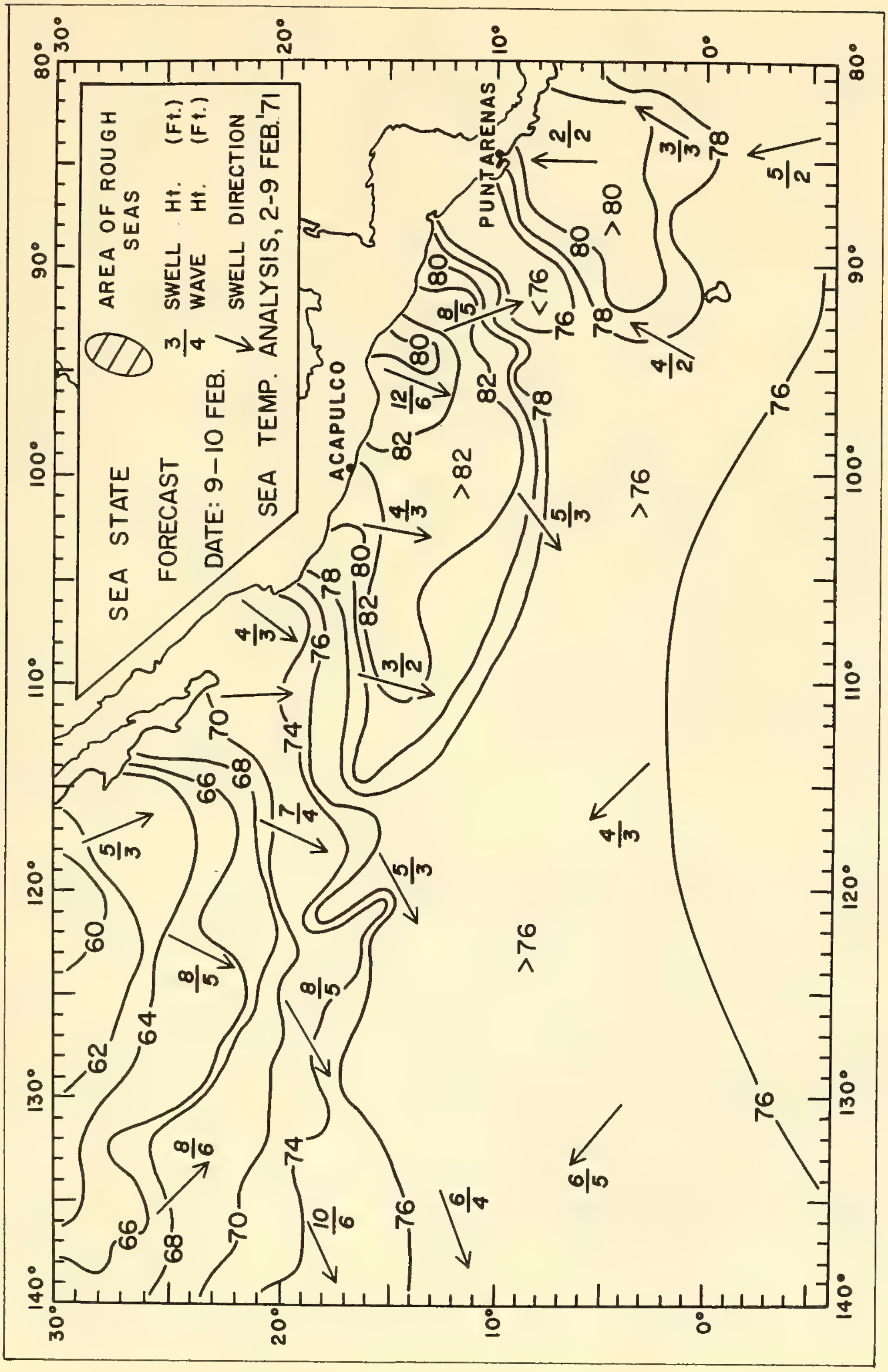


Fig. 1 – Sea state forecast and sea surface temperature chart.

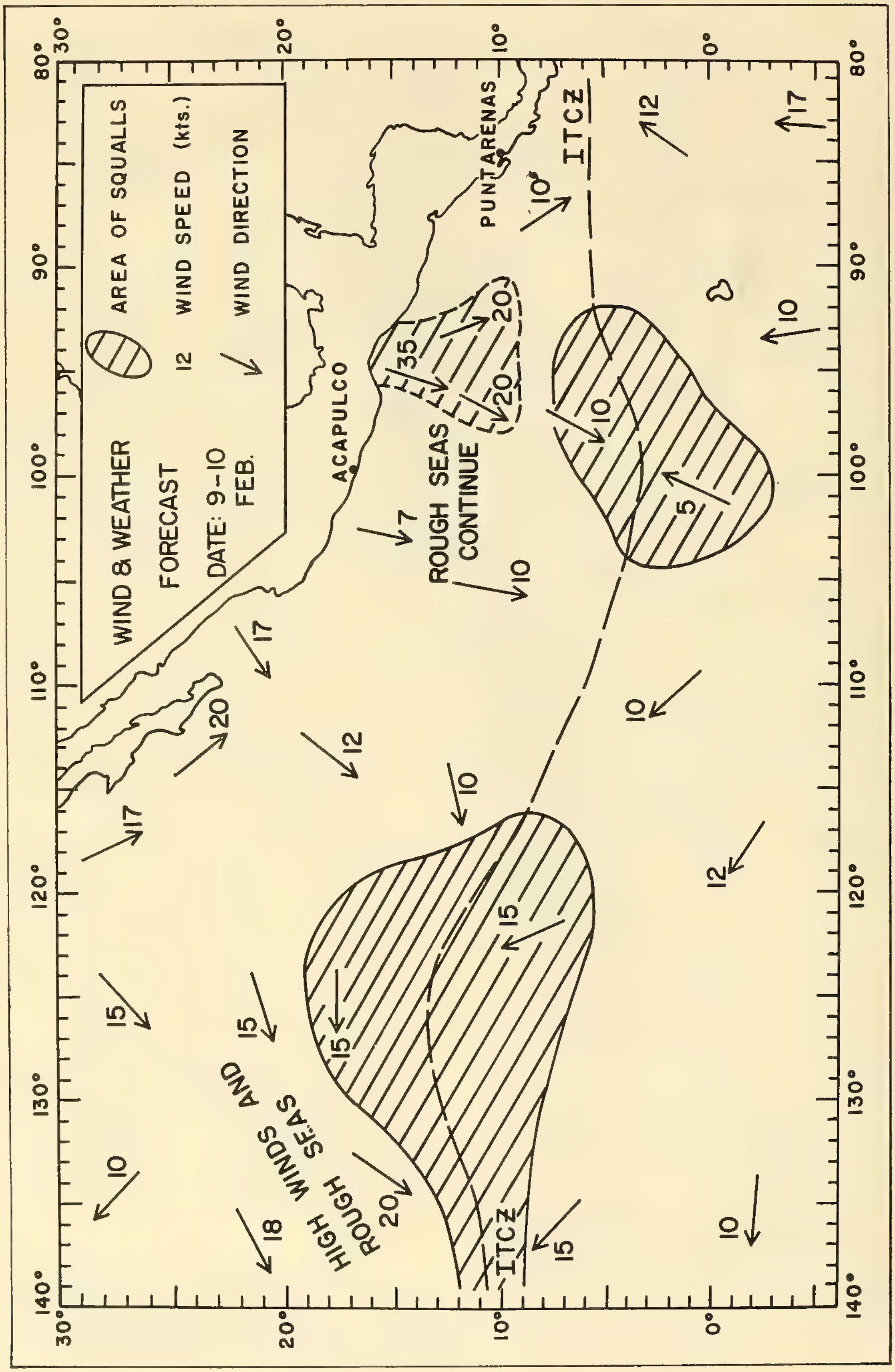


Fig. 2 - Wind and weather forecast chart.

OVERBOARD

With Chest Waders, Hip Boots, Or Rain Gear

R. O. Parker Jr.

Neither chest waders, hip boots, nor rain gear will cause you to drown if you don't panic. Waders, the most dreaded of the three, can actually be the safest. If you are wearing bulky clothing in addition to your boots, and do nothing after you enter the water, you will float.

If I fall overboard feet first, or if I wade into a hole over my head, will my waterlogged boots* and clothing cause me to sink? If I plunge in head first, will my boots and clothing trap air and cause me to float head down? The answers to these questions are of grave concern to sportsmen, commercial fishermen, and biologists. Most of us have heard the "answers" from various sources, often with vivid examples of personal experiences. But what are the facts? As a sportsman and a biologist, I am a frequent user of this equipment and have repeatedly been asked what to do in case of an emergency.

Fig. 1 - Equipment used in simulated accidents.

To demonstrate to myself and to others what actually happens under these circumstances, and what can be done about it, I carried out a series of simulated accidents in the harbor at Beaufort, N.C. In most instances, I wore a pair of trousers, sweat shirt, and winter jacket in addition to the boots and rain gear (fig. 1).

FEET FIRST

Fig. 2 - Temporary buoyancy results from air trapped in clothing and rain gear.

When you fall feet first into the water, air is forced out of your boots but is often trapped in your clothing, thus creating temporary buoyancy (fig. 2). Thrashing around in the water will not only tire you but will also cause you to lose this buoyancy. If you are wearing trousers and a T-shirt when you enter the water instead of bulky clothing, no air will be trapped in your clothing and you could sink several feet; however, it is a simple matter to return to the surface by raising your arms overhead, cupping your hands, and then pulling them to your sides at moderate speed. Using your legs in this situation is a waste of energy

The author, a fishery biologist and ex-Navy frogman, is with NMFS Center for Estuarine and Menhaden Research, Beaufort, N. C. 28516. Fishery Leaflet 635.

*Boots include chest waders, hip boots, and knee boots.

and time because the shape of the boots keeps you from using the surface area of your feet effectively for propulsion. Rapid stroking and kicking can eventually get you to the surface, but it is exhausting. Swimming and treading water while you are wearing these outfits, particularly the boots, is also exhausting. Therefore, I recommend removing the boots immediately. If no one is close by to help you, or if you are not able to stand, grab something, or reach safety by swimming just a short distance. By holding deep breaths, you can float at the surface, while removing the boots. This can be done easily after you have held them open to let them fill with water. Contrary to popular belief, water in your boots will not cause you to sink--because it is floating there to begin with, and obviously does not become heavier upon entering your boots.

If you are wearing waders, they can be quickly converted into a life preserver. After you allow them to fill with water, remove them and bring them to the surface upside down to drain most of the water. Hold the top of the waders on each side and work them behind you; then swing them rapidly overhead with the top held open and continue down into the water in front of you (fig. 3). At this point there should be more than enough air in the legs of the waders to keep you afloat. If not, repeat this procedure. Then, holding the top underwater, you can slide between the legs of your emergency "wader wings" (fig. 4).

Fig. 3 - Preparing to swing chest waders overhead to force air inside.

Fig. 4 - Chest waders can save your life when used as "wader wings."

HEAD FIRST

When you fall into the water head first, air is trapped in your boots as well as your clothing. But instead of causing you to float head down, as you might think, it causes you to float like a log (fig. 5). The same thing occurs (provided you hold your breath) when you fall in head first while wearing trousers and a T-shirt instead of bulky clothing. Although in this instance no air is trapped in your clothing on the upper half of your body, plenty of air can be held in your lungs to keep your head

Fig. 5 - Air trapped in chest waders and clothing causes you to float like a log.

afloat. By rolling on your back, you can float and breathe effortlessly for an extended period (fig. 6).

You need not be concerned about removing the boots and clothing immediately. Clothing, even in water, acts as an insulator. So, if you are in cold water, remove only as much as is necessary to enable you to swim to safety, or to tread water with minimum effort until help arrives. Remember, if you are wearing bulky clothing, slow to moderate strokes are more effective and much less exhausting than fast ones.

Most important of all, you have a good chance of surviving if you think about what you are doing and what effect it is having on you.

At the first opportunity, take your gear to a swimming pool or the beach with a couple of buddies to act as lifeguards. Then find out first hand exactly how easy it is to float and to remove your boots. It is fun, and it could save your life someday.

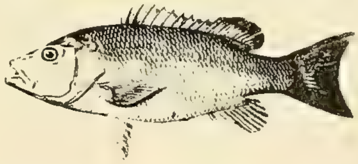
Fig. 6 - Floating and breathing effortlessly with air trapped in chest waders and clothing.

GRAY SNAPPER

'Investigations on the Gray Snapper, Lutjanus griseus (Studies in Tropical Oceanography No. 10),' by Walter A. Starck II and Robert E. Schroeder, 224 pp., 44 figs., clothbound, Nov. 1970, $12. University of Miami Press, Drawer 9088, Coral Gables, Florida 33124.

The book contains two separate studies of the gray snapper made near the Florida Keys.

I. The first is Walter A. Starck's "The Biology of the Gray Snapper, Lutjanus griseus (Linnaeus), in the Florida Keys." It investigates the species' life history: habitat, color patterns, morphology, feeding habits. It compares this history with that of 7 other common inshore lutjanids of the West Indies region. The author points out that this species is underexploited.



The snappers are a large group of generally medium-sized predaceous fishes common to tropical and warm temperate seas. They feed largely on crustaceans and fish. With several exceptions, they inhabit shore and shelf waters and, occasionally, enter fresh water. They are rated excellent food fishes and are important commercially in many areas. Several species (excluding Lutjanus griseus) have been connected with ciguatera poisoning. Many species are sought as game fishes.

The author says little is known about their biology--true too for most tropical fishes--and the group needs systematic review.

The gray snapper is the most abundant and widespread species of Lutjanus in the western Atlantic. It is particularly abundant in the Florida Keys. There, the extensive grass beds of Florida Bay and the nearby Florida reef tract unite to provide excellent habitats for young and adults.

II. The second monograph is Robert E. Schroeder's "Ecology of the Intestinal Trematodes of the Gray Snapper, Lutjanus griseus, Near Lower Metecumbe Key, Florida, With a Description of a New Species." It "examines seasonal changes of trematode populations in relation to movements, habitats, and the size and sex of the hosts."

Figures and tables illustrate the data in both studies.

FISHERY BIOLOGY

"Fishery Bulletin" of the National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Department of Commerce, Vol. 68, No. 2, Feb. 1971, pp. 177-346, illus., is a continuation of the Fishery Bulletin of the U.S. Fish and Wildlife Service.

Bulletins are distributed free to libraries, research institutions, State agencies, and scientists. Some bulletins are sold by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

This bulletin contains 10 technical articles on scientific investigations. They have been printed and issued as Separates.

"Young of the Atlantic Sailfish, Istiophorus platypterus," by Jack W. Gehringer, Jan. 1970, pp. 177-189.

In 1960 and 1962, 154 Atlantic sailfish were dip netted on cruises of BCF's charter vessel 'Silver Bay' off U.S. South Atlantic coast. This group was examined to determine changes during development. It was compared with 34 eastern Atlantic specimens dip netted in 1968 by BCF's 'Undaunted' in Gulf of Guinea. All study material is cataloged in the fish collections of BCF Tropical Atlantic Biological Laboratory, Miami, Fla.

"Mollusks and Benthic Environments in Hillsborough Bay, Florida," by John L. Taylor, John R. Hall, and Carl H. Saloman, March 1970, pp. 191-202.

This report relates the diversity and abundance of mollusks to bottom conditions in Hillsborough Bay, Fla., where dredging and pollution from domestic and industrial sources now control the ecology. The data are from benthic and hydrological surveys by BCF's Biological Laboratory, St. Petersburg Beach, Fla., during August-September 1963.

"Migration of Juvenile Salmon and Trout into Brownlee Reservoir, 1962-65," by Richchard F. Krema and Robert F. Raleigh, April 1970, pp. 203-217.

The migrations of juvenile chinook, coho, sockeye, and kokanee salmon, and rainbow trout from Snake and Weiser Rivers and from Eagle Creek were studied. Populations of fish were sampled with floating traps above reservoir and a fixed louver trap in Eagle Creek near lower end of Brownlee Reservoir. Age and length of fish, timing of migration, and numbers of fish of native or hatchery origin were determined. The information was needed to evaluate effect of Brownlee Reservoir on migrations of anadromous fish.

"Distribution and Movement of Juvenile Salmon in Brownlee Reservoir, 1962-65," by Joseph T. Durkin, Donn L. Park, and Robert F. Raleigh, April 1970, pp. 219-243.

The juvenile chinook, coho, sockeye, kokanee salmon were studied. Their rates and direction of movement, spatial distribution, and successful passage to outlet varied in relation to surface currents, water temperature, and dissolved oxygen concentrations.

"Emigration of Juvenile Salmon and Trout from Brownlee Reservoir, 1963-65," by Carl W. Sims, April 1970, pp. 245-259.

Floating scoop traps below Brownlee Dam caught samples of marked and unmarked salmon and trout that had left impoundment from July 1963 through August 1965; estimates of emigration were based on these samples.

Success of passage varied among years and populations. It was affected by the reservoir environment during outmigration. Downstream migrants that entered the reservoir early in season were more successful than later arrivals. Also, emigration was more successful when reservoir level was low.

"Characteristics of Some Larval Bothid Flatfish, and Development and Distribution of Larval Spotfin Flounder, Cyclopsetta fimbriata (Bothidae)," by Elmer J. Gutherz, May 1970, pp. 261-283.

The article discusses pertinent literature on larval flatfish of the family Bothidae and some characteristics helpful in identifying these larvae.

"Control of Oyster Drills, Eupleura caudata and Urosalpinx cinerea, with the Chemical Polystream," by Clyde L. MacKenzie Jr., May 1970, pp. 285-297.

Summarizes laboratory and field experiments during development of a method to control oyster drills for use on commercial oyster beds in southern New England and New York. This article includes the results of 15 treatments during 1961-67.

"Comparative Distribution of Mollusks in Dredged and Undredged Portions of an Estuary, with a Systematic List of Species," by James E. Sykes and John R. Hall, May 1970, pp. 299-306.

This report compares the numbers and varieties of mollusks in fine sediments of dredged canals with those in undisturbed bottoms of sand and shell in Boca Ciega Bay, Florida.

"Effect of Water Velocity on the Fish-Guiding Efficiency of an Electrical Guiding System," by John R. Pugh, Gerald E. Monan, and Jim R. Smith, June 1970, pp. 307-324.

The purpose of this study was to determine the effect of three water velocities--0.2, 0.5, and 0.8 meter per second--on the fish-guiding efficiency of an electrical guiding system operating under field conditions.

"Revision of the Genus Symphysanodon (Pisces: Lutjanidae) with Description of Four New Species," by William D. Anderson Jr., October 1970, pp. 325-346.

The genus is redescribed: four new species--two from western Atlantic and two from Pacific--are described; S. typus, from Pacific and, until recently, the only known species of the genus, is redescribed; a key to the species is provided. The author discusses systematic position of the genus, synonymies of species, and zoogeography and phylogency of genus; species are compared; there are brief comments on distributions.

THE FOLLOWING PUBLICATIONS OF THE DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE, ARE AVAILABLE FREE FROM DIVISION OF PUBLICATIONS, NOAA, CONNECTICUT AVE. & VAN NESS ST. NW., BLDG. 52, WASHINGTON, D.C. 20234:

FISHERY COOPERATIVES

"List of Fishery Cooperatives in the United States, 1969-70," Fishery Leaflet 627, 13 pp.

This leaflet contains only those organizations of fishermen recognized now by the U.S. Department of the Interior as cooperatives under Fishery Cooperative Marketing Act of 1934.

No two fishery cooperatives are identical. Each was organized to solve a problem--unique to fishermen of a geographic area. Therefore, the organizational and operational activities of each cooperative are different.

Two other lists are published, one for unions, another for associations: "List of Fishermen's and Fish Shore Workers' Unions in the United States," and "List of Fishery Associations in the United States."

FUR SEALS

"Fur Seal Investigations, 1968," by National Marine Fisheries Service, Marine Mammal Biological Laboratory, Sand Point Naval Air Station, Seattle, Washington 98115, SSR-Fisheries No. 617, 125 pp., 32 figs., 53 tables, 3 appendices, 1970.

The purpose of this research on Pribilof Islands was to appraise the reaction of the herd to population levels adjusted purposely to calculate level of maximum sustained yield.

The report has two parts:

Part I--"Fur Seal Investigations, 1968," summarizes information collected in 1968 and describes progress toward achievement of this goal.

Part II--"Pelagic Fur Seal Investigations, 1968," had these objectives: (1) to collect information on distribution of fur seals in winter, including arrival time of year-classes, and their feeding habits off Washington; and (2) to resurvey migration, distribution, and feeding habits of fur seals in waters of western Alaska with special emphasis on collecting young females to study reproductive condition in late spring and summer.

PLANKTON

"Macrozooplankton and Small Nekton in the Coastal Waters Off Vancouver Island (Canada) and Washington, Spring and Fall of 1963," by Donald S. Day, SSR-Fisheries No. 619, 94 pp., illus., 1971.

Predictions of the location and abundance of commercial fishes that depend on plankton for food can be improved by knowing the distribution and numbers of plankton within large regions of the sea. The waters over the continental shelf and slope along the west coast of U.S. and Canada appear to be one of world's highly productive marine environments. However, little is known about distribution and composition of macrozooplankton and small nekton inhabiting region off Vancouver Island, British Columbia, and Washington. This report shows abundance, distribution, and composition of these organisms over continental shelf and slope.

SALMON

"Distribution of Salmon and Related Oceanographic Features in the North Pacific Ocean, Spring 1968," by Robert R. French, Richard G. Bakkala, Masanao Osako, and Jun Ito, SSR-Fisheries No. 625, 22 pp., illus., 1971.

This report details fishing and oceanographic results of sampling in a wide area of North Pacific Ocean and presents data on relation between salmon distribution and oceanographic features.

"Effect of Quality of the Spawning Bed on Growth and Development of Pink Salmon Embryos and Alevins," by Ralph A. Wells and William J. McNeil, SSR-Fisheries No. 616, 6 pp., 1970.

This report describes the growth and development of embryos and alevins of pink salmon, Oncorhynchus gorbuscha, in natural spawning beds of different quality in Sashin Creek, a small stream in southeastern Alaska.

"Predation of Sculpins on Fall Chinook Salmon, Oncorhynchus tshawytscha, Fry of Hatchery Origin," by Benjamin G. Patten, SSR-Fisheries No. 621, 14 pp., illus., 1971.

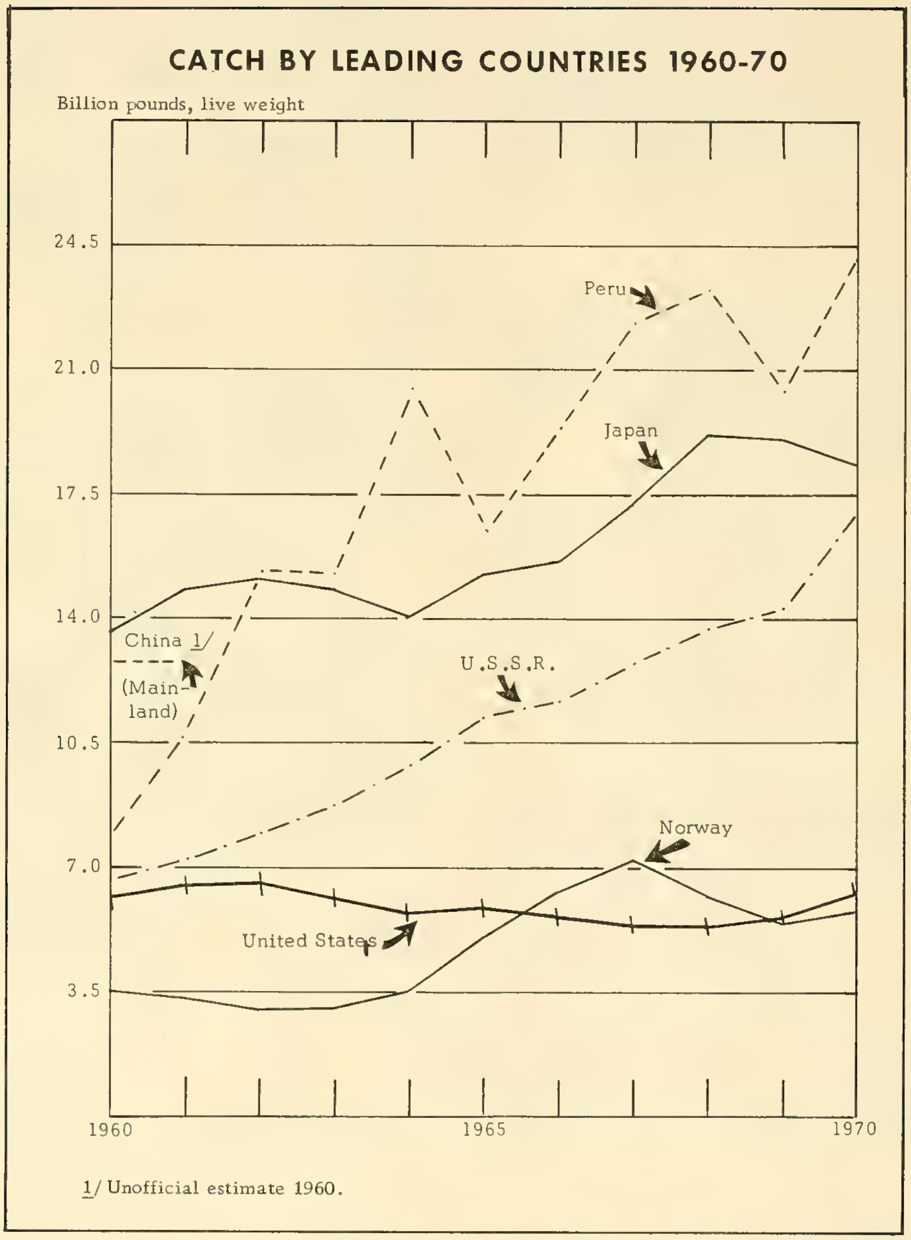
Patten studied predation by sculpins on fry of fall chinook salmon that migrated into Columbia River from two hatcheries: the Elokomin River Hatchery (operated by Washington's Department of Fisheries) and the Oxbow Hatchery (Oregon Fish Commission). Losses of salmon to sculpins may have been related to diet and to size of releases. In Elokomin River, predation was greater on salmon fed a wet diet than on those fed moist pellets. Improvement of hatchery procedures probably is best way to reduce losses of hatchery-reared salmon to sculpins.

SALMON & TROUT

"Spawning Areas and Abundance of Steelhead Trout and Coho, Sockeye, and Chum Salmon in the Columbia River Basin--Past and Present," by Leonard A. Fulton, SSR-Fisheries No. 618, 36 pp., illus., 1970.

Fulton discusses spawning areas removed from use before 1969 and those in use in 1969; abundance; and future of runs for: steelhead trout, Salmo gairdneri; coho salmon, Oncorhynchus kisutch; sockeye salmon, O. nerka; and chum salmon, O. keta. All four have lost many spawning areas because of water-use developments and changes in watershed resulting from logging, highway construction, agricultural cultivation, placer mining, and dumping of wastes.

Fulton says future prospects are fair for steelhead trout, good for coho salmon, and poor for sockeye and chum salmon.



1/ Unofficial estimate 1960.

U.N. USES NEARLY 100 FISHING VESSELS TO SEARCH FOR FOOD

In its search for more food for the developing nations, the U.N.'s FAO has dispatched a fishing armada of nearly 100 vessels to many parts of the world. This was reported by Sam Pope Brewer, The New York Times, on April 18.

The vessels fly both the U.N. flag and those of nations from which they operate. They have modern navigational and fish-finding gear. Many vessels have complete laboratories to study fish, test seawater, and to analyze samples of the aquatic life fish eat.

FAO Aims

The aims of the FAO program are to study the movements of fish, to discover new grounds, and to train fishermen to increase their catches. FAO scientists are training the people of underdeveloped nations to conserve the catch for use as food--or to use it in other protein forms, such as flour."

FAO Vessels At Work

In Lake Nasser, created by Aswan High Dam, 2 fishing boats built of steel-wire mesh covered by cement are being used to help develop the fisheries.

The first FAO vessel was the 40-foot tuna boat 'New Hope', bought in U.S. in 1952. It has seen much service: first in Somalia, then Iran, then Pakistan, where it helped develop shrimp fisheries.

53 Fisheries Projects

Today, FAO has 53 fisheries projects with investment of $130 million, over 300 experts, and 1,700 local seamen.

Some boats are built for specific projects; others are acquired and modified. The builders have been Japan, the Netherlands, Norway, Spain, and Britain. Each vessel is assigned to a project sponsored by government involved.

A project lasts about 5 years and may be renewed. In many cases, the vessels remain with countries that used them.

Achievements

Argentina has reported that the 107-foot 'Cruz del Sur' has set fishing records since its 1968 launching. It operates out of Mar del Plata as a combination stern trawler and purse seiner. An earlier project introduced the purse seine to Argentina.

Caribbean Fisheries

Three FAO fishing vessels have dramatically changed Caribbean fisheries for 16 countries and dependent territories. The vessels are 81-foot twins, 'Alcyon' and 'Calamar', and British-built 56-foot 'Fregata'. The twins were built in Japan in 1966 to cross Pacific under own power.

These territories, although spread over 1.5 million square miles of ocean, had depended chiefly on uneconomical imports.

Rome Headquarters

Headquarters for FAO's department of fisheries is in Rome. There, naval architects and marine engineers design the fishing vessels and arrange construction and delivery.

The department head is Jan-Olof Traung of Sweden. Its staff is from Iceland, the Netherlands, Sweden, Britain, and other countries.

Traung says new craft are launched and projects begun every year. They are designed for more than one kind of fishing. However, making them all-purpose ships would cost more than FAO can spend and be less efficient.

Small display stands carry variety of fish at Pusan fish market in South Korea. (FAO photo)

ASIA

JAPAN

HALF OF DOMESTIC FISHING GROUNDS ARE POLLUTED

The Japanese Fisheries Agency estimates that half the domestic fishing grounds are polluted beyond the safe level for marine animal life. Damage to the fishing industry is estimated at 15 billion yen (US$41.6 million) a year. This ominous announcement followed a nationwide survey of 227 fishing grounds by the Fisheries Agency in late Oct.-Nov. 1970.

The survey covered 44 prefectures, excluding Tokyo and inland 'Gumma,' which are conducting their own. Water, sea-bottom quality, and presence of heavy metals (like mercury and cadmium) were checked.

Many Below Safety Levels

An interim report on the findings of water-quality tests indicates that 61 (47%) of 129 marine coastal fishing grounds and 35 (over 50%) of 67 freshwater grounds failed safety levels for marine animal life. The Fisheries Agency estimated the yearly loss of fish and shellfish since 1968 at 15 billion yen.

The Agency said that pollution damage actually was much more extensive because number of polluted fishing grounds would increase when final figures are known. ('Yomiuri', Mar. 23.)

* * *

25th (1970/71) ANTARCTIC WHALING EXPEDITION ACHIEVED GOALS

On March 8, 1971, three Japanese whaling fleets in 25th (1970/71) Antarctic expedition attained assigned quotas of 1,493 blue-whale units (BWUs) and ceased operations. The 1970/71 quota was the same as in previous year. ('Suisan Tsushin', Mar. 15; 'Minato Shimbun', Mar. 13.)

On March 19, 1971, 'Mainichi' quoted whaling-industry sources as saying that record profits would be made from the 1970/71 Antarctic whaling operation. Prices for frozen whale meat averaged $500 per ton; finback whale oil $277 per ton; and sperm whale oil $333 per ton.

	Vessel and Owners			
Catch and Products	Tonan Maru No. 2 (Nihon Suisan)	Taiyo Maru No. 3 (Taiyo)	Kyokuyo Maru No. 3 (Kyokuyo)	Total
	(No. of Whales)			
WHALES:				
Fin	426	763	418	1,607
Sei	1,356	1,401	1,380	4,137
BWUs*	439	615	439	1,493
Sperm	130	443	761	1,334
	(Metric Tons)			
PRODUCTS:				
Baleen Whales:				
Fin whale oil	8,385.0	11,931.0	7,944.0	28,260.0
Frozen	25,643.8	30,495.0	22,193.0	78,331.8
Salted	750.7	302.0	416.0	1,468.7
Other	-	3,712.6	525.0	4,237.6
Total Baleen	34,779.5	46,440.6	31,078.0	112,298.1
Sperm whale	1,395.0	2,709.0	5,605.0	9,709.0
GRAND TOTAL (All whale products)	36,174.5	49,174.5	36,683.0	122,007.1

* One blue-whale unit = either 2 fin whales, $2\frac{1}{2}$ humpbacks, or 6 sei whales.

* * *

JAPAN (Contd.):

TUNA LONGLINERS IN ATLANTIC CONCENTRATE ON ALBACORE

Anticipating a favorable turn in U.S. albacore market, Japanese tuna longline fishermen in the Atlantic are concentrating on albacore.

Indications were that U.S. tuna packers would clear their canned white-meat tuna stocks by April or May because U.S. consumer purchases were picking up during Lenten season. The Japanese anticipate that demand for albacore will start building in June and higher prices will follow.

Main Albacore Grounds

The principal albacore areas in Atlantic are the northern grounds (near 30° N. latitude), off Cape of Good Hope (South Africa), and off Montevideo (Uruguay) where fishing is usually good. Most albacore taken in those areas are small (28-33 pounds per fish) and suitable for export to U.S. ('Katsuo-maguro Tsushin', Mar. 24.)

* * *

JAPANESE-GUATEMALAN SHRIMP VENTURE WAS PROFITABLE IN 1970

After 10 years of trying, the Nichiro Fisheries Co., Mitsubishi Trading Co., and Guatemalan interests reported profits in 1970. Their shrimp-fishing-and-processing venture at Champerico (Guatemala) was established in 1961.

In 1970, the joint company handled 1,171 metric tons of shrimp with a sales value of US$2.38 million. For first time, it declared a 5% dividend of about $27,800.

20 Shrimp Trawlers

The partners operate two companies: Pesca, S.A. and Copesgua, S.A. These own 20 licensed shrimp trawlers, 18 now fishing, and 2 being replaced with vessels under construction.

For several years, production was nearly stagnant. But, in 1968, heavy rainfalls suddenly increased abundance of shrimp. The catch has increased since then. ('Suisancho Nippo', Mar. 25.)

* * *

SUMMER ALBACORE TUNA FISHERY BEGINS

The 1971 Japanese pole-and-line summer albacore season off the home islands began in mid-March, about 2 weeks ahead of schedule. Fishing in April was good, promising a favorable fishery this year.

The catches, 100 to 200 metric tons a day, began to arrive at Yaizu and Shimizu in late March. Practically all albacore landings were bought by domestic packers at exvessel price of 280-290 yen a kilogram (US$706-731 a short ton). Indications were that price might advance to 300 yen per kilogram ($756 a short ton). ('Suisan Tsushin', April 10.)

* * *

'SURIMI' FLEET FINDS IMPROVING ALASKA POLLOCK FISHING

During good weather in March, 5 Japanese 'surimi' (minced fish meat) and meal factoryship fleets made good Alaska pollock catches in "Triangle area" of eastern Bering Sea. The fleets were trawling at around 250 meters (water temperature about 4° C.).

Fishing Schedule

The improvement in March catch over Jan.-Feb. has allayed fears that the resource is declining. Conceivably, the trawlers may have been scooping up only dense concentrations of a declining stock. From late April to early May, the fleets were scheduled to fish at shallower depths (around 100 meters) along Aleutian chain because Alaska pollock would be migrating shoreward to spawn. The catch during spawning season would provide a good indication of resource status. ('Suisan Keizai Shimbun', March 24.)

日本

S. VIETNAMESE FISHERIES MADE EXCELLENT PROGRESS IN 1970

One of the brightest reports from South Vietnam in recent months was the dramatic progress of her fisheries in 1970. The remarkable catch increase was due to various factors: growth of motorized and nonmotorized fishing fleets, more fishermen, use of synthetic fish nets, and improved general conditions.

Projects for the future include: 500 fish finders to modernize fishing vessels and 12 shipboard ice-making plants, expected soon.

On Phu Quoc Island, a fish-meal plant with a 5-metric-ton daily capacity will be installed. Interest is great in small shipboard fish-meal plants because about 25% of the catch is trash fish discarded by fishermen; inexpensive plants could help increase fishermen income substantially. (U.S. Embassy, Saigon, April 14.)

The Fisheries Directorate, Ministry of Agriculture, Saigon, provided these data:

	1969	1970	+ or - from previous year
	Metric Tons		%
Catch:			
Marine	355,488	441,765	+24
Fresh-water	63,673	74,140	+16
Shrimp	27,504	33,268	+21
Other crustaceans & molluscs	17,179	28,277	+65
Total	463,844	577,450	+25
	Number of Vessels		
Fleet:			
Motorized	39,001	42,603	+ 9
Nonmotorized	42,955	45,612	+ 6
Total	81,956	88,215	+ 8
	No.		
Fishermen	277,118	317,442	+15
	Metric Tons		
Exports:			
Shrimp	49.1	25.9	-47
	1,000 Liters		
Fishery products produced:			
Fish sauce	60,850	64,184	+ 5
	Metric Tons		
Cured fish	30,242	34,425	+14
Dried fish	20,769	27,979	+35

Shrimp sellers at market place of Rach Gia, S. Vietnam. (Keith Brouillard)

INDIA

TRAWLERS TO FREEZE SHRIMP AT SEA

Two 86-ft., double-rig, shrimp trawlers built in Mobile, Alabama, for Union Carbide India Ltd., have been delivered to Cochin (Kerala). Named 'Lakshmi' and 'Sunita Rani,' they will help modernize India's large shrimp industry.

Fig. 1 - A vast shrimp bed off Kerala, India, is fished by hundreds of Indian boats. FAO states the bed is more than 120 miles long and 4 to 6 miles wide. The bed yields the large, succulent prawns, prized in N. America and Europe.

Plants in Cochin freeze, pack, and export the shrimp, which earn much-needed hard currency.

FAO has aided Indian Fishery development in boat design and construction, mechanization, and gear technology. Hundreds of shrimp trawlers have been built from FAO designs.

In this photo are fisherman's house and fish-landing quay. Catch, mostly prawns, is sun dried. (FAO: C. Day)

The boats are equipped with freezers and refrigerated holds. The shrimp are cleaned and processed aboard within an hour of capture.

A Third Trawler

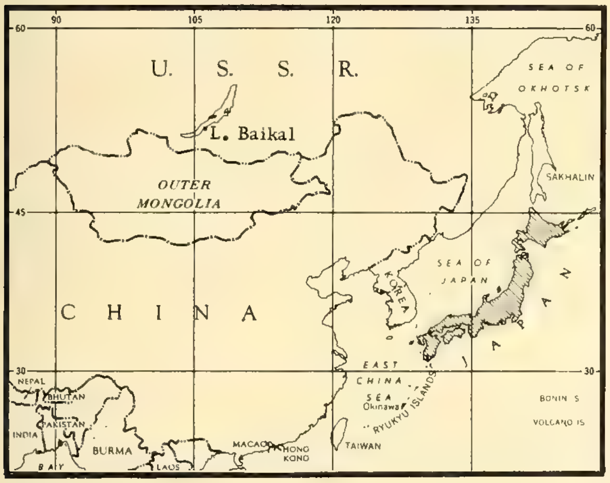
Each boat has a capacity to catch and process 500,000 lbs. of shrimp a year. They will work at sea for 15-day periods. A third trawler, built in Bombay, will join them later.

The frozen shrimp will be shipped to the U.S., Western Europe, and Japan. ('Fishing News International', Mar. 1971.)

Fig. 2 - Prawns sun drying at Cochin. This preservation method is used for local sales and nearby export markets. Quick-freezing and packing plants prepare prawns for export to European and N. American markets. (FAO: C. Day)

REPORT 2ND MILL PLANNED AT LAKE BAIKAL

The Soviet government is proceeding with plans to build a second wood-pulp mill on Lake Baikal's shore, a conservationist has revealed. The report, from Theodore Shabad in Moscow, appeared in The New York Times on April 18.



Some Soviet ecologists point to Lake Baikal as a striking example of the misuse of water resources in their country.

Nikolai G. Ovsyannikov, the conservationist, promised that a modern waste-treatment plant would maintain Baikal's unusual purity. But his disclosure has rekindled an old controversy.

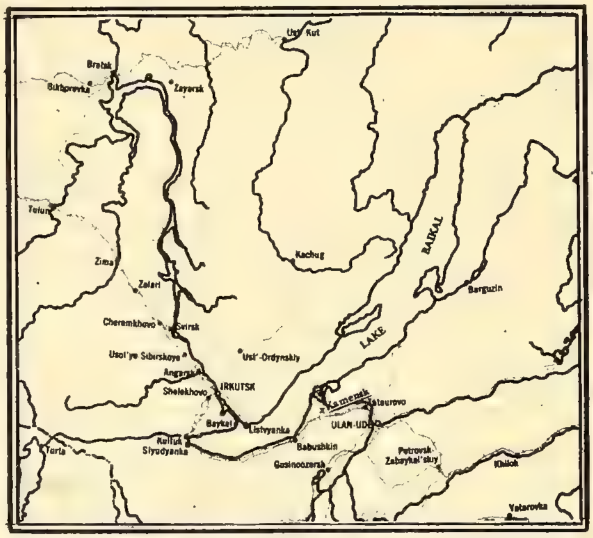
First Mill in 1966

Conservationists have been worrying about Baikal's future since 1966, when the first pulp mill began operations in Baikalsk, a town on the lake's southwest end. They protested the discharge of effluents. To meet their protests, a specially designed treatment plan was added to the mill. This did not placate the critics, who argued that no treatment plant could preserve the lake's quality. The remarkably transparent water contains many unusual plant and animal species.

2nd Long Planned

Planning the second mill has proceeded sporadically, as controversy heated and cooled, for about a decade. The site is Selenginsk, near Kamensk, 100 miles northeast of mill one.

Ovsyannikov stated at a Moscow news conference held during meeting of Society of the Conservation of Nature: "An advanced 3-stage treatment system will remove all toxic material from waste waters and preserve Baikal as one of the cleanest lakes in the world."



He is president of the society, a Russian Republic organization, which claims 19 million members.

Other Soviet republics have similar societies.

Conservationists vs. Planners

Baikal is an old battleground between conservationists and industrial planners--despite the adoption in 1969 of a decree ordering strict measures to halt pollution.

The industrial planners argue that the forests of Baikal region must be cut because country badly needs pulp for the tough cord used in cars and in airplane tires.

USSR (Contd.):

SOME DEVELOPMENTS AND TRENDS: 1971-75

Expansion plans for the Soviet fishing fleet continue full speed: the Fisheries Ministry announced a 30% increase in BMRTs (Soviet-built factory stern trawlers of 'Maiakovskii' class) for 1971-75. East German deliveries of fishing vessels will continue at same pace. Domestic construction of "super-trawlers" is being pushed.

Catamaran fishing vessels have not yet reached commercial stage, but tests will continue.

Gear

The fleet will be equipped with electronic trawl-control devices for midwater trawls, and with wide-mesh nets. Purse seining will be adopted on large scale. Three techniques are being perfected for industrial use: (a) discharging catch from purse seines by pumps, (b) "contactless" transshipment of catch, (c) container delivery of catches to motherships.

Fishing Off U.S. and Canada

'Atlantik'-class stern trawlers are being dispatched to fish for herring and mackerel in the area supervised by International Commission for the Northwest Atlantic Fisheries. Exploration for new herring grounds is being intensified. Fishing on Continental Slope (depths between 500 and 1,500 meters) is being tested.

ICELAND

RECORD CAPELIN CATCH EXPECTED

The 1971 capelin season, which started Feb. 16, promises to be the best ever. By March 7, 60 boats had caught 117,000 metric tons, compared with 68,000 at same time in 1970.

As of March 10, with weather ideal, there was no end in sight to large catches. A second large run had been tracked off southeast coast. It was expected to follow along south coast on heels of first run, which earlier reached southwest tip. Storage tanks were overflowing; some boats had to come as far as Reykjavik to unload.

The season was expected to last through March. Last year's record catch was 191,000 metric tons; the 1971 prospects were even better.

Unrelated to Norwegian Stocks

Ichthyologists say the different number of vertebrae in Icelandic stocks indicates no connection to Norwegian stocks. They also claim that stocks of capelin are not endangered by huge catch as the herring stocks were.

Advance Contracts

More capelin meal has been sold under advance contracts than last year. Contracts have been signed with Sweden, Denmark, U.K., and Poland for 20,300 metric tons and 7,200 metric tons of capelin oil.

Prices are only slightly higher than last year's: US$3.24-$3.36 per protein unit for meal, and about $238 per metric ton for oil.

Advance contracts for sale of 5,600 metric tons of frozen capelin to Japan also have been signed at prices varying from $80 to $190 per ton according to roe content of mature females. These roe-rich capelin are delicacies in bars.

1970 Exports

In 1970, Iceland's total capelin exports were (metric tons): frozen 1,020; meal 29,776; oil 5,742. Japan received all the frozen capelin. The largest buyers of meal and oil were Denmark, Sweden, Finland, Britain, Hungary, and East Germany. (U.S. Embassy Reykjavik, Mar. 10.)

WEST GERMANY

DEEP-SEA FLEET TO ADD 15 FACTORY STERN TRAWLERS

West German trawler owners have ordered 15 new factory stern trawlers from 4 shipyards for deliver in 1972 and 1973. The present fleet has 108 vessels (116,000 GRT). Total investment for the 15 will be US$82.5 million. Such vessels have operated mostly off Greenland, Labrador, Newfoundland, and the U.S. east coast.

The new vessels, which have government support, will replace technically outdated vessels; the latter will be reconstructed into fresh-fish vessels. The head of Deep-Sea Fisheries Association says new construction of fresh-fish vessels is too costly, but reconstruction of already depreciated old vessel is possible.

Technical Improvements

The vessels, similar to units built during last 5 years, will include technical improvements: 40-50-ton freezing capacity per day, and cold-storage space for 800 tons of frozen products. They will have a crew of 70. ('Fiskets Gang', Feb. 25.)

SPAIN

REPORT ON 1970 FISHERIES

The Madrid newspaper "Informaciones" reported, Jan. 23, on Spanish fisheries during 1970:

The catch was estimated at more than 1.5 million metric tons with exvessel value of about US$336 million.

Lloyd's Register of Shipping credits Spain with world's third largest fishing fleet: 1,289 vessels over 100 GRT, and total fleet of 678,436 GRT. The freezer fleet is modern; even the salt cod or bacalao fleet has been modernized.

Freezer Fleet

The first freezer vessel, "Lemos", entered the fishery in 1961 and is still fishing. During 1966 the freezer fleet had 62 vessels (56,666 GRT); in 1969, 123 vessels (110,052 GRT). Production capacity is somewhat over 3,000 tons per day; in 1969, production reached 146,800 tons of frozen fish worth US$71.8 million. The freezer fleet suffered major setbacks, particularly in 1968, but these were resolved through more varied production.

Salt-Cod Fleet

The salt cod (bacalao) fleet had problems in 1968/69. But it has stablized production at about 270,000 tons of raw fish. This indicated that 1970 salted-fish production would be about 90,000 tons. In 1970, Spain exported more than 57,000 tons of salted fish.

In 1970, the first research vessel began to conduct research between Canary Islands and Sahara. A 20-nation fleet is fishing uncontrolled there.

Exports

Fishery exports in 1969 were 133,876 metric tons worth US$65.8 million. Spain has a large market in Europe. Since none of the Common Market countries represents a major fishery nation, the EC imports much from outside countries. Although Norway, Denmark, and Iceland dominate those markets, Spain's products are not in direct competition, especially not in molluscs. Latin America and Africa are the most important markets for Spanish salt fish and cod. (Reg. Fish. Att., Copenhagen, from 'Fiskets Gang,' Feb. 18.)

UNITED KINGDOM

1970 CATCH SET RECORD

In 1970, the exvessel value of British landings in England and Wales jumped US$24 million from 1969 to reach a record $186 million. Landings rose 21,000 tons to 960,000 long tons.

Landings of demersal fish (719,000 tons) were at 1969 level, but exvessel value rose from $133 million to $153 million. This increase was due mainly to a rise in average landed value of cod. Value of plaice increased; haddock's dropped slightly. Herring prices were higher and lifted pelagic landings from 173,000 tons to 185,000 tons, and from $9.5 million to $13 million. These are provisional figures compiled by U.K. Ministry of Agriculture, Fisheries and Food.

Shellfish landings increased more than 11% above 1969 in quantity and value.

Exports & Re-Exports

There was a substantial rise of 43% in exports and re-exports of fish and fish products--from 105,000 tons to 150,000 tons. Imports dropped sharply from 901,000 tons in 1969 to 766,000 tons, but value rose from $276 million to $301 million.

Fish-meal imports dropped from 460,000 tons to 363,000 tons, value from $76 million to $75 million. There was a smaller drop in imports of fish oil: 246,000 tons to 220,000 tons, but value rose from $34 million to $51 million. ('Fishing News', March 5.)

ITALY

SETS TEMPORARY GUIDELINE FOR MERCURY IN FISHERY PRODUCTS

Italy has set a temporary mercury tolerance level of 0.7 part per million, plus a 10% allowance, or a maximum limit of 0.77 ppm for fishery products. This was reported by the Japanese Fisheries Agency and trading firms.

The guideline is valid from April through June 1971. After that, Italy will make a final determination based on test results.

The new regulation can sharply affect Japanese exports of tuna, swordfish, and sharks to Italy.

How Fish Tested

During test period, Italy will draw out 10 samples from each lot. The entire lot will be rejected if: the mercury content in all samples averages above guideline; two or more fish contain an excess concentration; or if one sampled fish contains 1.5 times more mercury than allowed. ('Suisan Tsushin', Apr. 13.)

Fish stall in Rome market. (Robert K. Brigham)

LATIN AMERICA

LONG-AWAITED FISHING LAW IS ISSUED

On April 2, the official Brazilian newspaper 'Diario Oficial' carried the Decree Law governing fishing within the 200-mile territorial sea. The law became effective with publication.

I. Two fishing zones are established: from the coast to 100 miles, and 100-200 miles. In the inner 100 miles, fishing is restricted to Brazilian vessels. Both foreigners and Brazilians can fish in the second 100 miles.

Exploitation of "crustacea and other living resources depending on the subject bottom Brazilian territorial waters" are reserved for Brazilian vessels.

Vessels "in the regime of lease to Brazilian legal entities, having headquarters in Brazil" are considered to be "equal" to local vessels.

In "special circumstances," the Ministry of Agriculture, through SUDEPE (Brazilian fisheries ministry), in consultation with the Navy, might permit foreign fishing within inner 100-mile zone. Legislation covering fishery research vessels will be dealt with later.

Registration

II. Both national and foreign vessels must be registered. "National" status will be granted "exclusively to Brazilian born or naturalized citizens or companies organized in the country under Article 8, Decree Law 221, Feb. 27, 1967."

To get Ministry of Agriculture authorization to lease foreign fishing vessels, the applicant must prove: his capital is owned predominantly by Brazilians; the crew has the stipulated number of Brazilians; the operation will expand exports or supplies in a deficit production zone. The leasing authorization, good for one year, may be extended for one more. After lease termination, the vessel must be "nationalized" to continue operation.

Foreign vessels not on lease may fish within the outer 100-mile zone when authorized. Authorization for a maximum of one year is renewable. It will stipulate equipment and process permitted.

The request for authorization to SUDEPE must be made by a "reliable Brazilian legal entity," which will assume legal and financial responsibilities. The application should include name, nationality, description of vessel and gear; also, a statement that there is room for an "element" designated by SUDEPE or the Navy to accompany vessel.

Foreign vessels will be required to pay a \$500 registration fee, plus a \$20/NRT fee. Foreign captains must: (1) use SUDEPE-approved sailing charts; (2) know and respect Brazilian law, particularly concerning pollution; (3) use SUDEPE-approved equipment and techniques; and (4) report arrival and departure times in Brazilian waters, plus daily position, to the Navy. Foreign vessels can unload only with SUDEPE special authorization.

Punishing Violators

III. "Trespassers" will be escorted to nearest port captain. Foreign vessels fishing without authorization will be prosecuted for smuggling. Brazil can impound the vessel, gear, and catch, and prosecute the captain. Violators also can be fined. The navy will ask for air force surveillance.

IV. SUDEPE will establish catch limits for species in each zone for national and foreign vessels. It will take other necessary conservation measures.

Provisions of the law may be modified by treaty. (U.S. Embassy, Rio de Janeiro, April 2.)

PERU

NEW FISHING LAW CONFIRMS 200-MILE LIMIT

Peru's new General Fisheries Law confirms State control over all her marine resources up to 200 miles from the coast. The Ministry of Fisheries is authorized to direct all fishery development.

Most important, no new foreign investment is allowed in the fishmeal industry. Existing foreign firms are required to give up majority holdings. Supposedly, the transfer of control is to be done without harming the interests of those foreign-controlled companies regarded as technically and economically competitive.

To Redistribute Income

A unique plan aims to redistribute income among the workers through profit-sharing. The workers will share in the ownership and management of their factories.

The industry is defined as public and private, but "socially owned" fishing companies also are allowed. The public sector is represented by the Ministry of Fisheries and autonomous public companies: Public Fisheries Service Co. (EPSEP) and Public Fishmeal and Fishoil Marketing Co. (EPCHAP). Private companies may be local, foreign, or joint ventures.

Foreign companies must sign a contract with the government stating how long it will take to transfer at least 51% of their capital to local investors.

Goals of New Law

Fishing companies are to be encouraged and developed by the State in accordance with a scale of priorities: first, fishing for food fish; second, fishing for nonfood consumption; third, fishing for indirect human consumption (fish meal).

The law creates a Fishing Community and a Fisheries Compensation Community. Both are designed to strengthen the fishing companies and to promote social solidarity among workers, employers, and the State. Every year, each firm must deduct 22% from net profits, free of tax--2% for research and training fund; 8% in cash for communities; and balance of 12% toward community's share of firm's capital. ('Peruvian Times', April 2.)

Fishmeal plants work round the clock. This is view at night. (FAO: R. Coral)

CANADA

SALTFISH CORPORATION HAS GOOD YEAR

Despite the problems of organization and getting under way, the Canadian Saltfish Corporation (CSC) was able to sell all the saltfish available and could have sold much more during its first period of operation. Sales in such areas as New York, Puerto Rico, the Caribbean Islands (particularly Jamaica), Portugal, and Italy were bigger than ever; CSC also sold in new areas, such as Chicago.

CSC has a staff of 35, including 8 quality-control inspectors. The latter's presence has improved the market's reputation.

In Short Supply

The major problem now facing CSC is inadequate supply. Two years ago, the government had to buy up vast quantities of surplus salt fish for its foreign-aid program to save fishermen from economic disaster; now CSC is finding that it cannot supply its market demand. This is true particularly of lightly salted fish for which U.S. and Italian demand considerably exceed supply. CSC officials have been meeting with fishermen to assure increased supply this year.

Why the Change?

The causes for this change are not completely clear. To some extent, this is because of increased competition for fish from frozen-fish trade. Market prices there have risen sharply, so the trade is buying more fish. The frozen-fish trade does not require fishermen to be concerned about "added-on-value," which salting and curing do require.

In addition to Newfoundland, Nova Scotia and Quebec supply salt fish to the world. It is expected that these Provinces will join CSC this year. The supply of salt fish from New Brunswick and Prince Edward Island is comparatively small; their membership would not appreciably affect market. (U.S. Consulate, St. John's)

* * *

BRITISH COLUMBIA'S 1970 HERRING SPAWN WAS WELL ABOVE AVERAGE

The 3-year closure of British Columbia's herring fishery appears to have achieved its goal of returning deposition alongs its shores to adequate levels. The 1970 spawn deposition has exceeded substantially the 25-year average, reports the Canadian Department of Fisheries.

Department's Report

"In 1970, 290 miles of spawn were deposited in British Columbia waters, over twice as much as in 1969 and well above the 25-year (1940-64) average of 199 miles," a department report stated. Spawning abundance was above average in most subdistricts, except for Northern and Upper West Coast of Vancouver Island (only satisfactory levels), and Queen Charlotte Island and Southern Mainland, which are still below average.

The spawning in Feb.-Mar. 1971 would indicate whether resumption of fishing would be possible this year. Several thousand tons already have been taken in the food fishery.

SOUTH PACIFIC

AUSTRALIA

VALUE OF FISHERIES DECLINED IN 1969/70

In 1969/70 (July 1, 1969-June 30, 1970) total exvessel value of fish, crustacea, and mollusc was US$63,530,000, $458,000 below previous season and first decline since 1957/58. These are preliminary figures of Bureau of Census and Statistics.

Spiny Lobster Value Dropped

The decline was due almost entirely to a 27% drop in value of spiny lobster catch--$29,830,000 to $21,864,000. The catch dropped 13% from 28,884,000 pounds in 1968/69 to 25,160,000 pounds in 1969/70. In Western Australia, the main lobster-producing State, the catch fell to 15,294,000 pounds, lowest since 1957/58.

Shrimp Catch Value Rose

The 1969/70 shrimp production increased in quantity and value. Catch was 29,290,000 pounds, up 37% from previous season; value rose 47% ($15,420,000). Shrimp is Australia's second most important fishery.

The value of oyster production rose, but scallop dropped 20% to $906,372. Abalone production increased 13% from previous season. Australian wet-fish landing for 1969/70 increased in quantity and value; a record tuna catch in New South Wales was main reason.

Despite slump in lobster catch, Western Australia retained its position as Australia's leading fishing state. ('Australian Fisheries')

* * *

CHANGES TO METRIC SYSTEM

Australia has converted to the metric system. It will take 10 years to change over completely and cost about US$112 million. Despite this, Australia is expecting great benefits. At present, Japan, her major trading partner, penalizes certain Australian imports that do not conform to metric system.

90% of World Uses Metric System

About 90% of the world uses the metric system, and 75% of world trade is transacted in metric units. The only major countries resisting change are the U.S. and Canada.

In East Asia, many countries have adopted the metric system. So have New Zealand and South Africa.

On Feb. 15, 1971, Britain changed to the decimal system. One pound now is divided into 100 pence, each worth $0.024. The transition was smooth and painless. Conversion is expected to be completed by 1975.

AFRICA

SOUTH AFRICA

PILCHARD QUOTAS CUT

Growing concern in South and South-West Africa over the effect of heavy fishing on pelagic shoal fish stocks is reflected in the 1971 quotas for the 8 factories on the coast of South-West Africa. Seven are in Walvis Bay, one in Luderitz. There is a sharp cut in the amount of pilchards the factories can catch for their canneries and meal plants. This could lead to a reduction in South African canned pilchards on world markets.

There has been a spreading intrusion of anchovy among pilchards off South-West Africa and, to an even greater extent, among related stock to the south off South Africa's Cape Province.

A Cape west coast pilchard and maasbanker cannery and fish reduction plant.

Pilchard & Anchovies

During the past 3 years, the amount of pilchards received by the shore factories has been between 1.1 and 1.4 million short tons a year; anchovy increased from 327,000 tons in 1967 to 365,000 tons in 1968 and 437,000 tons in 1969.

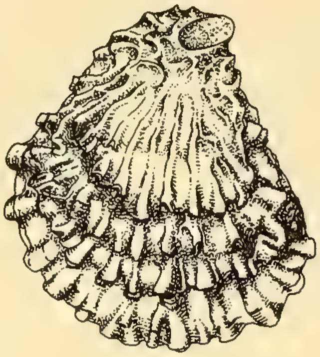
In South-West African waters during 1970, the ratio of anchovy to pilchards in the catch was about 1 ton in 5. In South African waters, to Sept. 1970, the pilchard catch was only 46,000 tons; anchovy catch, 237,000 tons.

Pilchard Quota Cut

The government is trying to prevent the South-West African anchovy intrusion from growing to level in South African waters. It has slashed pilchard quota for each factory from 90,000 tons to 45,000 tons, plus a 45,000-ton quota for anchovy.

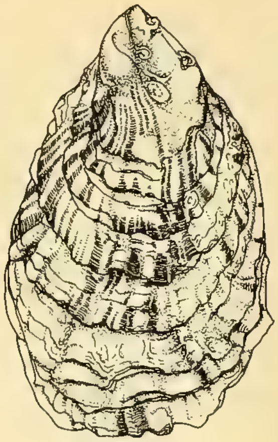
The South-West Africa pelagic shoal fishing season was shortened by two months this year. It started Feb. 15 and will close Sept. 15. ('Fishing News International')

FOOD FISH FACTS



Crassostrea virginica

OYSTERS



Crassostrea gigas

Although no one knows how many centuries oysters have been enjoyed as food, it is known that oyster farming has been practiced in the West since the days of the Romans, and that oysters were cultivated in China long before the Christian Era. Early settlers in America were delighted to find an abundance of excellent oysters along the coastlines and in the bays of their newly found land. Today oysters are more popular than ever. Oysters are still available and harvested from public oyster beds; however, most of today's oyster market is supplied by men who farm the waters along the shorelines of many states.

DESCRIPTION

The oyster is a bivalve mollusk belonging to the Ostreidae family. More than a hundred living species in this large family have been described, but only a few are of economic importance. True oysters are distinguished by having dissimilar lower and upper shells and these shells or valves are hinged together by a complex elastic ligament. The upper valve of the shell is normally flat, while the lower is concave, providing space for the body of the oyster. The two valves fit together making a watertight seal when the oyster closes, providing the shell has not been damaged or broken. Near the center of the oyster's body is an adductor muscle, attached to both valves, which controls the opening and closing of the shell. There are three important species of oyster which are enjoyed in the United States. They are:

The Eastern or Atlantic oyster Crassostrea virginica is found along the Gulf Coast and up the Atlantic Coast to Cape Cod. The Eastern oyster represents approximately 85 percent of the total production.

The Pacific oyster Crassostrea gigas, recently called Pacific king oyster, is grown in coastal waters from Alaska to Northern California. The biggest production area is centered in the Puget Sound, Gray's Harbor, and Willapa Harbor areas of Washington State. This oyster is grown from seed imported from Japan. The Pacific oyster comprises about 15 percent of the production.

The rare Western oyster Ostrea lurida, also known as Olympia oyster, is native to the Pacific Coast. The yield of this species has declined because of predators, water pollution, and increased cost of production. Some Olympias are still available and it is hoped that, through conservation methods, the cultivation of this species can be increased.

(Continued following page)

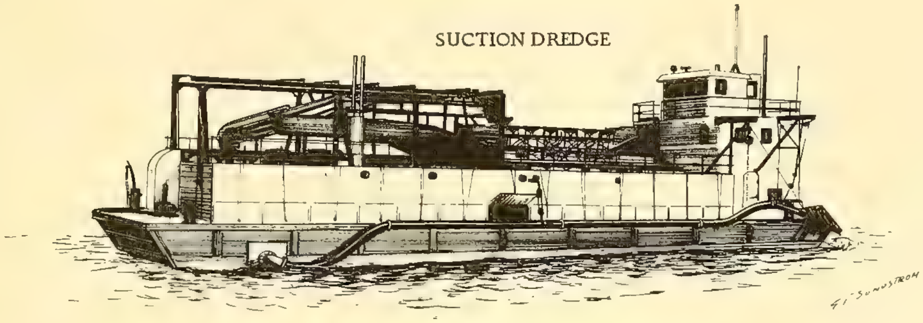
HABITAT

Oysters are found along the temperate and tropical coastlines of all continents. They live and grow between tidal levels or in the shallow waters of bays and estuaries; however, some oyster species live in waters several thousand feet deep. Oysters can adapt to living in waters with considerable changes in salinity and temperature but the growth is more rapid in warm waters and a marketable size is reached much quicker than in lower temperatures.

OYSTER HARVESTING

A number of methods are used in harvesting oysters. In some areas, where there are natural oyster beds, no mechanical methods are allowed and the harvest is done by hand-picking during low water or by the use of manual tongs. If the oysters are plentiful, a tonger may take up to 25 to 30 bushels a day. In other areas, such as the public grounds of Chesapeake Bay and Connecticut, only hand-operated dredges are permitted. Privately owned or leased oyster beds are harvested by large machine-hoisted dredges, or by suction dredges which work on the same principle as a vacuum cleaner. Suction dredges are very efficient in carrying oysters and other materials up from the bottom to the conveyor on the deck of the dredge boat. The suction dredge, in addition to harvesting oysters, helps to clear the beds of starfish, mussels, and other enemies of oysters. The escalator or scooper-type of harvester is used effectively in relatively shallow water.

SUCTION DREDGE



MANAGEMENT AND CONSERVATION

Oysters occur along practically every coastal area in the United States. However, many formerly prolific oyster beds have been depleted because of over fishing and a lack of cultivation. Pollution is also a very serious factor. In an attempt to assist the States in better management of their fishery resources, Congress passed two major pieces of grant-in-aid legislation. They are the Commercial Fisheries Research and Development Act of 1964 and the Anadromous Fish Act of 1965. Both Acts authorize the Secretary of the Interior to enter into cost-sharing cooperative agreements with States and other non-Federal interests for commercial fisheries research and development. These programs are administered by the National Marine Fisheries Service. State response has been excellent, but there is still much to be done in the conservation of oyster growing areas as well as in other fishery problems.

USES OF OYSTERS

Oyster meats are an excellent source of high quality protein, minerals, and vitamins, and they are easily digested. Because of the high mineral content, oysters are often recommended by doctors for patients with anemia. Oysters can be used in a wide variety of cooking methods and have special appeal because they are easily and quickly prepared. To retain the oyster's delicate flavor, never overcook. Oysters should be cooked just long enough to heat through and remain plump and tender. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio, Rm. 526, Chicago, Ill. 60611.)

INDEX

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BACK COVER: Gill nets drying on a beach in Ecuador. These catch surface-swimming fish by their gills. (FAO: S. Larrain)

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Administrator	Deputy Administrator	Associate Administrator

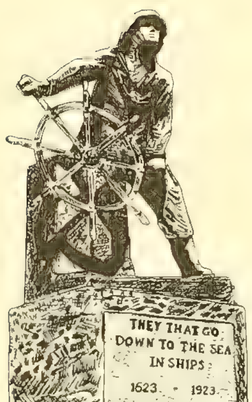
NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: Worker at Sitka, Alaska, processing plant inspects herring roe before it is packed for shipment to Japan.
(NMFS-Alaska Photo: J.M. Olson)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).



Fishermen's Memorial
Gloucester, Mass.

Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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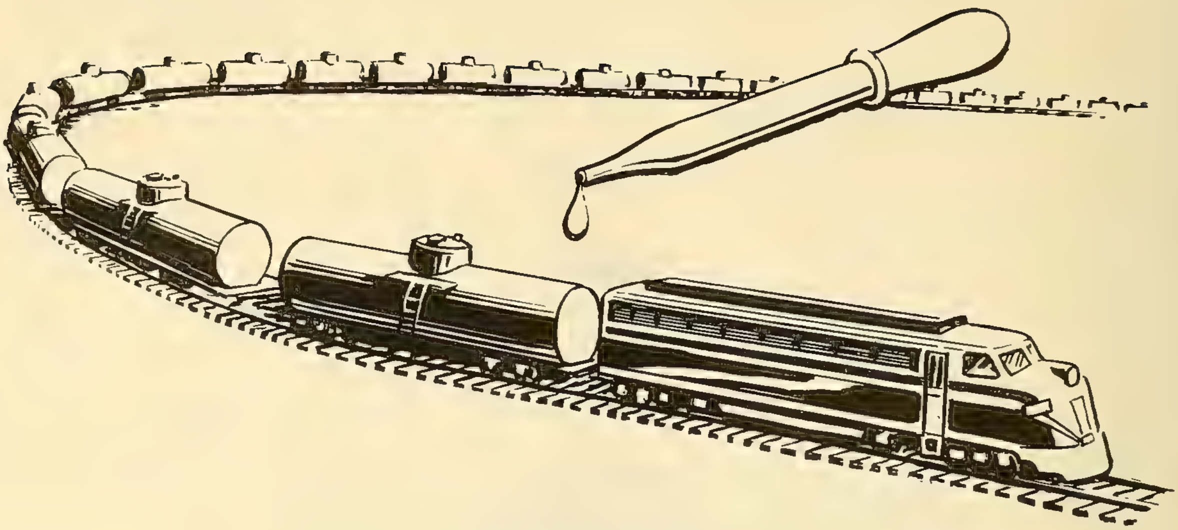
CONTENTS



Laboratory tests reveal that some pesticides in fantastically small amounts kill crabs and shrimp. One part of DDT in a billion parts of water will kill blue crabs in 8 days. (One part per billion is about the relationship 1 ounce of chocolate syrup would bear to 1,000 tank cars of milk.)

Commercial brown and pink shrimp, exposed to a 0.3 to 0.4 part of heptachlor, endrin, or lindane in 1 billion parts of water were killed or immobilized in 48-hour laboratory tests. In the laboratory, paralyzed fish or shellfish may live for days, even weeks. But in the sea, where only the fittest survive, death may result almost immediately.

PESTICIDES PERIL OCEAN LIFE, SCIENTISTS WARN

Up to 25% of DDT compounds so far produced "may have been transferred to the sea," a Panel of the National Academy of Sciences has reported in "Chlorinated Hydrocarbons in the Marine Environment."

The scientists emphasize: "This report is not intended to represent an exhaustive survey of the literature. It has been prepared to alert the community of marine scientists to one of the more serious problems arising from the dispersal of man's materials to his surroundings. Emphasis has been placed upon DDT and its degradation products because they have been the most studied to date."

The amount of DDT compounds in the living things of the sea is estimated at below 0.1% of total production. But even this small percentage has had a "demonstrable impact upon the marine environment."

Bird populations that eat fish have failed to reproduce and have declined. And, as greater quantities of persistent chlorinated hydrocarbons accumulate in the marine ecosystem, more species will be threatened. These pollutants will reach "unacceptable levels" in the tissues of marine food fish.

Long-Lasting Harm

The experts state that it is very hard to set an exact figure on certain risks involved in using chlorinated hydrocarbons, but these risks require serious consideration. The rate at which such substances become harmless is unknown, but some of the more persistent materials remain deadly for years, even decades or centuries.

The future may hold even greater peril for marine life. If most of the remaining 75% of the persistent chlorinated hydrocarbons is now in reservoirs, but in time will reach the sea, then marine organisms will take in greater amounts despite improvements in future manufacturing practices. If these compounds last longer than decades, it will be virtually impossible to undo the damage.

In a grim cautionary note, the Panel states that the story of pesticide problems has revealed unexpected effects in the past decade. "Our prediction of the potential hazards of chlorinated hydrocarbons in the marine environment may be vastly underestimated."

PANEL RECOMMENDATIONS

The NAS Panel recommends:

- An extensive and immediate U.S. effort should be made to drastically reduce escape of persistent toxicants into the environment. The goal would be to virtually end this escape as soon as possible.

- Design programs to: determine entry rates of each pollutant into oceans; make base-line determinations of how these pollutants are distributed in the different parts of that environment. Later, a program should be devised to monitor long-term trends to see what progress has been made--"and to document possible disaster."

- Because the evidence shows some of these substances degrade the environment, the laws covering registration of chemical substances and release of production figures by government "should be examined and perhaps revised."

U.S. & WORLD PRODUCTION OF CHLORINATED HYDROCARBONS

Th U.S. uses about 30% of its production of DDT and 70-80% of its production of the aldrin-toxaphene group: aldrin, chlordane, dieldrin, endrin, heptachlor, and toxaphene.

World production data are hard to obtain because the available information is inadequate. But FAO data in 1969 suggest "that the total world production of DDT and the aldrin-toxaphene group is probably no more than one and one half times that of the U.S."

It is "even more pressing" to learn the production figures for the polychlorinated biphenyls, which have been used since the early 1930s.

PANEL ON MONITORING PERSISTENT PESTICIDES IN THE MARINE ENVIRONMENT

of the

COMMITTEE ON OCEANOGRAPHY

NATIONAL ACADEMY OF SCIENCES

Edward D. Goldberg, Chairman
Philip Butler
Paul Meier
David Menzel
Gerald Paulik
Robert Risebrough
Lucille F. Stickel

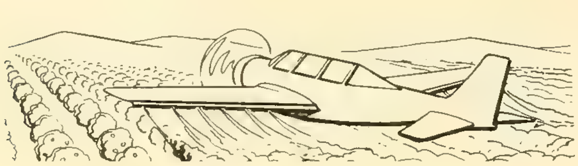
ROUTES OF DDT RESIDUES + PCBs TO MARINE ENVIRONMENT

After DDT is applied on land, its residues make their way to the ocean via rivers, sewage outfalls, and the atmosphere. DDT residues are DDT, DDE, and DDD. DDD and DDE are metabolites of DDT; DDD itself is a pesticide.

DDT residues reach the atmosphere in several ways: aerial drift during application by rapid vaporization from water surfaces, and by vaporization from plants and soils. When they are in the atmosphere, DDT residues may travel thousands of miles. They enter the ocean in precipitation or in dry fallout. The NAS Panel states: "There are few data for estimating these rates of transfer."

DISTRIBUTION OF CHLORINATED HYDROCARBONS IN MARINE ENVIRONMENT

There are few data to document concentration of chlorinated hydrocarbons (including PCBs) in open-ocean environment. But some observations reveal that DDT and its residues are probably distributed throughout marine biosphere.



- Gray whales concentrate up to four tenths (0.4) of a part of DDT residues in a million parts of their blubber. These whales feed largely on bottom-dwelling organisms in the Chukchi and Bering Seas. Sperm whales feed on larger open-sea organisms.

- Sea birds--petrels and shearwaters--feed on planktonic organisms far from land. Their concentrations of DDT residues run as high as 10 ppm.

- Such migratory fish as tuna harbor as much as 2 ppm in their gonads. Other marine mammals carry as much as 800 ppm in their fat. It is not known whether these concentrations resulted from localized contact in coastal waters--or were accumulated during their life in the open ocean.

- In the coastal environment, DDT and its residues range from undetectable levels to 5.4 ppm in oysters. Concentrations within these limits are highly variable, even within same estuary.

ECOLOGICAL IMPACT

The NAS Panel states: "The acute and chronic toxicity of chlorinated hydrocarbons has been identified by observing the effects of chlorinated hydrocarbons under controlled laboratory conditions. The exposure of test populations of marine fauna to several dilutions of these pollutants in flowing seawater has shown that they affect growth, reproduction, and mortality at concentrations currently existing in the coastal environments."

PLANKTON

Adding chlorinated hydrocarbons to laboratory cultures of molluscan larvae--and the phytoplankton they eat--causes (with increasing concentrations) "decreased growth rates, developmental failures, and increased mortality."

In one southeastern U.S. estuary, toxaphene levels were high enough to have killed most of phytoplankton suitable as food for molluscan larvae.

In the open ocean, phytoplankton are the base of the food chain. They may be primary concentrators of chlorinated hydrocarbons from the water.

CRUSTACEANS

In bioassay tests, laboratory populations of commercial species of shrimp and crabs, and zooplankton, are killed by exposure to chlorinated hydrocarbons, such as DDT and PCB, in parts per billion (ppb).

Exposing shrimp continuously to DDT concentrations of 0.2 ppb killed all of them in 18 days. A concentration of 0.12 ppb killed all in 28 days.

Such concentrations have been found in Texas rivers flowing into commercially important shrimp nursery areas. In such contaminated areas, there are significant mortalities of juvenile crustaceans.

In California, declining production of Dungeness crabs "may be associated" with DDT residues in the developing larvae.

Polychlorinated biphenyls (Aroclor 1254) at 5 ppb killed 72% of test populations of pink shrimp (Penaeus duorarum) in 20 days. These shrimp had accumulated 33 ppm of PCB in their tissues.

MOLLUSKS

The chlorinated pesticides and PCBs hinder oyster growth. One ppr of PCB Aroclor 1254 produces 20% decrease in shell growth.

Many pesticides interfere with oyster growth at levels as low as 0.1 ppb.

Mollusks concentrate these chemicals. They indicate pollution levels in marine waters. Monitoring coastal samples have shown that amount of chlorinated hydrocarbon residues in mollusks are correlated directly with application rates of these agricultural chemicals in adjacent river basins.

FISH

Nearly the world over, marine fish are contaminated with chlorinated hydrocarbon residues. There are expected concentrations in such lipid tissues as the ovary.

On the south Texas coast, in speckled sea trout, DDT residues in ripe eggs are about 8 ppm. This level may be compared with residue of 5 ppm in freshwater trout that causes 100% failure in development of sac fry or young fish.

"The evidence is presumptive for similar reproductive failure in the sea trout." In Texas's Laguna Madre, sea-trout inventories declined progressively from 30 fish per acre in 1964 to 0.2 fish per acre in 1969. Few juvenile fish have been observed in recent years. But only 100 miles away, in less contaminated estuaries, the distribution of sea-trout year-classes is normal.

In California, the sale of some mackerel has been banned because DDT residues were too high, even in the processed fish.

In the Mississippi River, in 1963-64, a large fish kill was traced to chemicals entering river system from insecticide-manufacturing plant. Very high endrin amounts were found in nearby sewers and in riverside dump.

Laboratory experiments showed that concentration of several chlorinated hydrocarbons, including DDE, damage reproductive success of birds, fish, and marine invertebrates.

BIRDS

"Chlorinated hydrocarbon residues have seriously affected both adult birds and their reproduction."

Deaths of bald eagles, common loon, and peregrine falcons have been correlated with deadly amounts of chlorinated hydrocarbons in body tissues.

In the Netherlands, many coastal birds died and the population of sandwich tern declined. This was traced to dieldrin

contamination of Dutch Wadden Sea and coastal North Sea resulting from factory effluent.

In the Baltic Sea, sea eagle reproduction has failed and deaths occurred because of very high levels of DDT compounds and PCB in the tissues.

Studies of museum series of eggs showed that, since mid-1940s, eggshell thinning has occurred in many species of fish-eating birds and birds of prey. Where there was shell thinning, the population usually declined. Eggshell thinning and the population decline that followed were linked to chlorinated hydrocarbon residues in eggs and in body tissues of birds.

In U.S. Atlantic Coast sites, black duck egg samples showed highest residues of chlorinated hydrocarbons in states where duck reproduction is poorest.

In southern California's marine ecosystem, concentrations of DDT compounds in fish may be greater than 10 ppm. In 1969, there was a catastrophic failure of reproduction among brown pelicans on Anacapa Island as a result of egg-shell collapse.

BIOCHEMICAL EFFECTS

The Panel states that "several physiological effects of chlorinated hydrocarbons could account for shell thinning and for the abnormal behavior observed in contaminated populations."

When they affect nerves, the chlorinated hydrocarbons, including DDE, "are believed to block the ion-transport process by inhibiting one or more ATPases in the nerve membrane that causes the required energy to be made available."

RECOMMENDATION: A NATIONAL EFFORT TO CURTAIL LONG-TERM EFFECTS OF CHLORINATED HYDROCARBONS ON COMMUNITY STRUCTURE

The Panel makes clear that these changes in the earth's living systems are part of an even more portentous pattern of changes in the "structure of the natural communities of estuaries, coastal regions, and the oceans." The familiar pattern is connected with stepped-up eutrophication and pollution of water bodies.

In the water, simplified communities of eutrophic lakes and estuaries develop. Harvestable fish populations often are depressed. Bird populations are dominated by scavengers, such as the herring gull.

The problem in the water is greater than that on land. This is because reduction of consumer populations is accompanied by a shift in plant species to hardy algae. The algae are not eaten by grazers. Worse, their production accumulates. There is less oxygen. And, the potential of the area to support man further diminishes.

Many factors cause these changes. But, the Panel states, the building up of persistent chlorinated hydrocarbons in estuaries and in coastal waters have made these agents major factors in speeding this pattern of change.

The Panel recommends: "A massive national effort to effect a drastic reduction of the escape of persistent toxicants into the environment, with the ultimate aim of achieving virtual cessation in the shortest possible time. Only in this way can we hope to curtail the deleterious effects of chlorinated hydrocarbons upon community structure."

RECOMMENDATION: A CHLORINATED HYDROCARBON BASE-LINE PROGRAM FOR THE MARINE ENVIRONMENT

There has been little analysis of chlorinated hydrocarbons in materials from the marine environment--and from parts of atmosphere and continental hydrosphere that provide these pollutants to the waters.

An effective monitoring program cannot begin "until the present dissemination of these materials at the earth's surface is detailed." A beginning can be made with a reasonable monitoring program by using a base-line study. This would determine concentrations of chlorinated hydrocarbons in geological and biological components of the marine environment, and in their transporting agencies. "Such an investigation can conceivably be carried out in a year."

The Panel believes that using a single laboratory to manage the program would minimize standardization problems of sample preparation and handling. It thinks of a thousand analyses during the first year's baseline program. "Temporal, geographic, and

spatial sampling procedures will be formulated for each of the groups of substances."

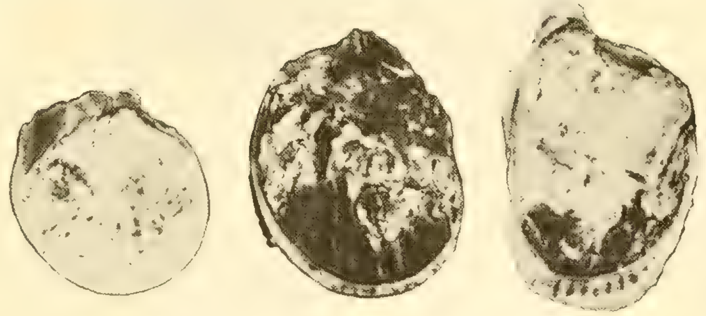
RECOMMENDATION: REMOVAL OF OBSTACLES TO PUBLIC ACCESS TO CHEMICAL PRODUCTION DATA

The NAS Panel lists among the causes contributing to lack of available data on chlorinated hydrocarbons a legal structure: when there are no more than 2 producers, they can withhold production figures as privileged information.

The scientists believe that "it is not in the public interest for government to maintain as privileged data that are necessary for research into the state of our environment and for an assessment of its condition."

And the Panel concludes: "We recommend that the laws relating to the registration of chemical substances and to the release of production figures by the Department of Commerce and the Bureau of the Census be reexamined and revised in the light of existing evidence of environmental deterioration. The protection afforded manufacturers by government is an artificial obstacle to effective environmental management, particularly with reference to the polychlorinated hydrocarbons. In view of other impediments--technological, methodological, and financial--such protection is clearly inappropriate."

Where the concentration of DDT is as low as 10 parts in a trillion parts of water, the oyster collects and stores the pesticides. Oysters have stored DDT during a 40-day exposure period to levels 70,000 times greater than a 0.1 p.p.b. concentration in surrounding water. Put back in clean water, oysters can, in time, eliminate the pesticide.



1 2 3

Typical effects of pesticides on growth of experimental oyster shell after 96 hours.

1. Control oyster with about one-fourth inch of new growth.
2. Oyster where exposure to a pesticide decreased growth by about 50 percent.
3. Oyster in which pesticide was so toxic it prevented any new shell formation.

The illustrations in this article come from "FISH, WILDLIFE and . . . PESTICIDES," written by Edward Edelsberg for Fish and Wildlife Service.

PUBLIC SHOULD CONTINUE TO EAT FISH & SHELLFISH, NOAA ADMINISTRATOR SAYS

Fish should remain a very worthwhile part of the American diet, Dr. Robert M. White, NOAA Administrator, recently told the Shellfish Institute of North America. He said it would be "needless and tragic" if the finding of mercury in a small number of fishes caused consumers to avoid all fish.

Dr. White emphasized: "There is no reason whatever not to eat--and enjoy--fish and shellfish."

Pledges Full Study

He pledged that NOAA's National Marine Fisheries Service (NMFS) will try to find out quickly and thoroughly the extent of mercury or other heavy metals in fish. NMFS will "keep the public informed, not only of those products with high levels but those which fall below the guidelines offered by the Food and Drug Administration."

Dr. White said NOAA works closely with the Food and Drug Administration (FDA) to help protect the public against fish contaminants. He added: "So far, what we have found gives us reason for optimism. Since the mercury problem first came to light about a year ago, swordfish is the only species that the FDA felt should be the subject of a warning to the public.

"I have faith in the common sense of the American people. I am confident that they will be guided by specific cases and will not deprive themselves of the nourishment, the economy, and the pure enjoyment of eating the vast majority of fish, which there is no reason to distrust."

SHELLFISH SITUATION

Richard W. Surdi & Donald R. Whitaker
NMFS Current Economic Analysis Division

Supplies of all shellfish, except calico scallops, decreased during the first 3 to 4 months of 1971. The lower level of imports this year, especially for shrimp and northern lobsters, has been a major reason for the present lack of supplies. Although imports of scallops from several countries and imports of lobster tails from Australia and South Africa increased, most shellfish-producing nations are experiencing declining catches; so U.S. imports have declined.

In addition to lower imports, domestic landings have been down during the first months of 1971. This drop has been due to several factors, including bad weather and lower abundance.

Another supply complication has been the rapid decline in holdings of frozen shellfish. Cold-storage holdings generally decline during the first part of the year for most species. During the first 4 months of 1971, however, the rate was much more rapid than in previous years. To satisfy the market, and to compensate partially for declining imports and landings, processors and retailers have drawn heavily from inventories. Consumption of shellfish during the early months of 1971 was about the same or only slightly below 1970. This stability is especially impressive in light of the sharp gains in prices for most species and the lower quantities available to be consumed.

The increase in prices has affected domestic and imported shellfish. While U.S. and world demand has continued to rise, relatively stable or declining supplies have boosted import prices.

OUTLOOK

The shellfish outlook during May-July was for continuation of the first 4 months' trends. Supplies were expected to remain below 1970. Rising prices at record levels and expected lower supplies probably would keep consumption at 1970 level. Demand, however, probably would remain strong.

Shrimp

Sales of fresh and frozen shrimp during January-April 1971 were a little over 100 million pounds, heads-off weight--a gain of about 2% from 1970. Sales were impressive in view of the early months of 1971.

The importance of shrimp inventories was never more evident than in the first 4 months. U.S. shrimp landings were down about 3 million pounds from January-April 1970. Shrimp imports declined 14 million pounds in the same months. Despite declines in landings and imports, sales actually gained a little over last year. The gain was possible because of inventory withdrawals. Between January 1 and May 1, 1971, inventories of frozen shrimp dropped 28 million pounds--15 million more than last year. Thus, inventories made up practically all the deficit in landings and imports. Exports of shrimp were also down in the first four months. This made more shrimp available for the domestic market. The combination of these supply factors enabled sales to gain a little in January-April.

If imports continue to decline, it will be difficult for sales to remain at year-ago levels. Inventories cannot continue to make up the import deficit. Preliminary indications pointed to another decline in imports in May--the sixth consecutive month imports have fallen below corresponding months in 1970. Shrimp landings in the Southern States during the summer are expected to be no higher than last year.

Unless imports show a quick turnaround, shrimp sales this summer likely will be off from last year.

Scallops

Supplies of sea scallops were 7.9 million pounds during the first 4 months of 1971. This was a slight decrease from a year ago. January-April landings of 1.4 million pounds were about 18% below same period in 1970. A slight

increase in imports partially offset the decline in domestic landings. Increases in imports from the United Kingdom and several other countries compensated for a large decline in shipments from Canada.

Consumption of sea scallops at 6.2 million pounds during January-April was 5% below 1970. The decline can be attributed to lower supplies and higher prices.

Supplies of sea scallops during the summer are expected to continue lower than in 1970. Domestic landings likely will continue low. Although the high prices of scallops would seem to indicate the probability of higher imports, this is unlikely because of the declining trend in imports from Canada. Increases in imports from other countries may just offset the Canadian decline.

Northern Lobsters

Supplies of northern lobsters at 5.8 million pounds, live weight, were 7% below first-quarter 1970. Maine landings fell 13% to 611,000 pounds, and compelled wholesale dealers to rely primarily on "pound" lobsters. Imports from Canada declined 6%.

The quantity demanded during first-quarter 1971 was light due to record high prices. Exvessel prices generally rise for the first 3 months of the year and then fall in April. Prices paid to fishermen not only rose an unusual amount, 32 cents during January-March, but continued to rise into April.

Lobster landings, which are seasonally low in the first quarter, generally increase in April and rise steadily until the peak in September or October. Prices normally drop during May, then rise during June and July. The normal seasonal pattern is expected to be followed this year but at a higher level than a year ago.

Spiny Lobster Tails

Supplies of spiny lobster tails were 17 million pounds during first 4 months of 1971--down about 2.5 million pounds from last year. Most of this decline resulted from lower inventories. Imports were higher in the first quarter but dropped in April. Inventories have been averaging about 40% lower than a year ago.

Demand has been strong. Sales were above the previous year during the first quarter despite sharply higher prices. At 10.2 million pounds, sales were up about 9% during January-March. Consumption, however, fell nearly 20% in April; the April decline resulted mainly from lower supplies. Prices of lobster tails have risen sharply in 1971--\$.60 to \$1.00 higher than in 1970.

Supplies of spiny lobster tails are expected to continue lower than a year ago during the summer; prices may edge up a little more from May levels and average well above a year ago.

West Coast Crabs

Production of West Coast crabs was off sharply in first-quarter 1971. Total landings were an estimated 32 million pounds compared with 49 million pounds in January-March 1970. Landings of dungeness and snow crabs were about half those a year ago, while king crab landing were marginally higher.

With generally shorter supplies likely in 1971 for West Coast crabs, some gradual strengthening in prices is likely this summer, especially for king and dungeness crabs. With prices of most shellfish at record high levels, and supplies generally lower, the possibility exists for some substitution of crab products.

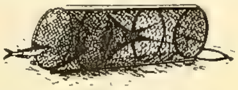
A SABLEFISH FISHERY MAY BE POSSIBLE OFF CALIFORNIA

Two collapsible sablefish pots, developed by NMFS Seattle, were bought and assembled by NMFS Fishery-Oceanography Center, La Jolla, Calif. The pots measure 96"x 33"x 33". The large catches of sablefish (Anaplopoma fimbria) reported by Seattle base indicate that the pots fish more efficiently than standard longline gear.

Abundant Off S. California

The fish apparently are abundant off southern California in 100-500 fathoms. The main product in the U.S. is sold smoked, but local restaurateurs and fish dealers have shown interest in marketing the fresh product.

In the past, sablefish landings in southern California have been almost zero. R. Green of La Jolla is trying to interest local fishermen in making trial market catches.



JUVENILE JACK MACKEREL ADAPT TO FOOD DEPRIVATION

As part of its study of the ability of juvenile fish to survive food deprivation, NMFS La Jolla completed measurements of the respiration of starved jack mackerel. The researchers found that the basal level of respiration did not differ significantly from control, well-fed fish; it indicated that food energy is used up at about the same rate during starvation.

The Testing

The starved fish lost weight and 2-3g of body fat. But, after 45 days, these fish still were able to swim at sustained speeds only slightly slower than well-fed fish. This took place in an exercise machine where swimming speed was controlled. However, there was a behavioral adaptation to starvation: the juvenile jack mackerel, when permitted, reduced their overall swimming activity. Feeding began as soon as food was given to the starved fish. An increase in overall swimming became evident immediately.

NOAA AWARDS GRANT FOR PACIFIC ADVISORY PROGRAM

NOAA has awarded a $36,500 Sea Grant to support a Pacific Sea Grant Advisory Program (PASGAP). The program seeks to help many users of marine resources whose work carries them beyond the boundaries of a single state.

The NOAA grant went to Oregon State University, Corvallis. It will be administrator for 6 other participants: universities of Alaska, British Columbia, California, Hawaii, Washington, and National Marine Fisheries Service.

Fishermen of the northeastern Pacific usually seek certain species over wide areas. Often it is difficult to pass along to them useful extension advisory services. The salmon troll fleet ranges from California in the spring to Alaska in the summer and fall. Albacore tuna fishermen travel from Baja California to Vancouver Island.

The new NOAA-supported program will tie the productive marine advisory programs already in operation from Alaska to California. These programs are spurred by Sea Grant and state, provincial, and local programs.

Already, PASGAP has produced, with the participating groups, the first Commercial Fishermen's Directory of Emergency Services, and an inventory of publications and films on marine resources.

The NOAA grant will help produce more publications, conferences, and workshops geared to provide timely information to marine-resource users.

CALIFORNIA'S ANCHOVY-FOR-REDUCTION SEASON CLOSED MAY 15

California's open fishing season for anchovy to be reduced into meal, oil, and solubles, which began Aug. 1, 1970, was closed at midnight May 15, 1971. Nearly 80,000 short tons were landed, only about 73% of 110,000-ton quota, reported California's Department of Fish and Game.

In the last 4 open fishing seasons, landings were 83,473 (1969-70), 28,050 (1968-69), 6,506 (1967-68), and 37,615 (1966-67) tons.

NMFS PREDICTS GOOD ALBACORE FISHING OFF SOUTHERN CALIFORNIA

Commercial and sport fishermen should have a good albacore season in California coastal waters south of San Francisco, predicts Dr. R. Michael Laurs, NMFS laboratory in La Jolla, California.

Based on the historical trend of commercial albacore catch distribution and environmental conditions, commercial fishermen will catch an estimated 25 to 35 million pounds south of San Francisco, and 15 to 22 million pounds north of it. Sport boats will do well in southern California waters.

Favorable Conditions

Dr. Laurs and his colleagues say that there will be cooler-than-average sea-surface temperatures on the U.S. west coast particularly in the northwest; and stronger-than-normal north-northwest winds. These conditions favor local biological enrichment of the ocean and adequate food for the migrating tuna.

Dr. Laurs explained that the commercial albacore fishery was centered south of San Francisco during 1960-64. It shifted to Pacific Northwest in 1965 when ocean temperature in this area indicated a warmer-than-normal trend. The northward swing peaked in 1968: 85% of west coast catch was north of San Francisco, mainly in Oregon and Washington waters. In 1970, only about 65% of west coast commercial catch was north of San Francisco. It appears albacore fishing will continue return towards waters south of San Francisco.

Cruise Updates Information

To keep forecast information up to date, NMFS fishery biologists, meteorologists, and oceanographers, under Ron Lynn, were scheduled to leave San Diego, Calif., about June 28, aboard NMFS research vessel 'David Starr Jordan' for 19-day cruise to study migration route of albacore into U.S. coastal waters from central Pacific. The scientists were to troll jiglines and observe life history of albacore by studying age, length, weight, sex, stomach contents, and other statistics.

Also, observations would measure distribution of oceanographic features associated with albacore migration. Included would be plankton net hauls to obtain estimates of food available for albacore.

The commercial fishing vessel 'Typhoon' was slated to leave Newport, Oregon (about June 15) to make a preseason scouting survey 400 to 500 miles offshore from about Cape Mendocino southward to Erben Bank. Periodically, the Typhoon would radio sea-surface and subsurface temperature data and fishing information to Dr. Laurs at La Jolla via radio station WWD.

AVERAGE SEA SURFACE TEMPERATURE

The 11-year average (1960-70) of the optimum temperature zone for albacore for July 1-15 is shaded in Figure 1. The bulk of albacore are taken in this temperature range. Prevailing weather during July 1-15, 1971, "will no doubt cause deviations from this average pattern," which will influence albacore distribution. NMFS La Jolla will monitor evolving temperature patterns to project distribution as season develops.

RECENT TRENDS IN OCEANIC & ATMOSPHERIC CONDITIONS

The latest available observational data indicate that sea-surface temperatures along U.S. west coast from Vancouver Island to tip of Baja California--and out to longitude 135° W--are 2° (F) below average temperatures computed for past 10 years. These below-average conditions continue a pattern that has persisted since January 1971. The 60° isotherm normally begins northward advance between 125° W and 135° W in May; this year, it appeared to start earlier and reverse cool trend. But the momentum of early warming was short-lived: the 60° isotherm was still well south of its normal location in second half of May (Figure 2). These short-term events at beginning of the warming season help little to project probable distribution of sea temperature in mid-summer. NMFS La Jolla cautions that continued monitoring and careful interpretation may lead to forewarning of changes in trends over longer periods.

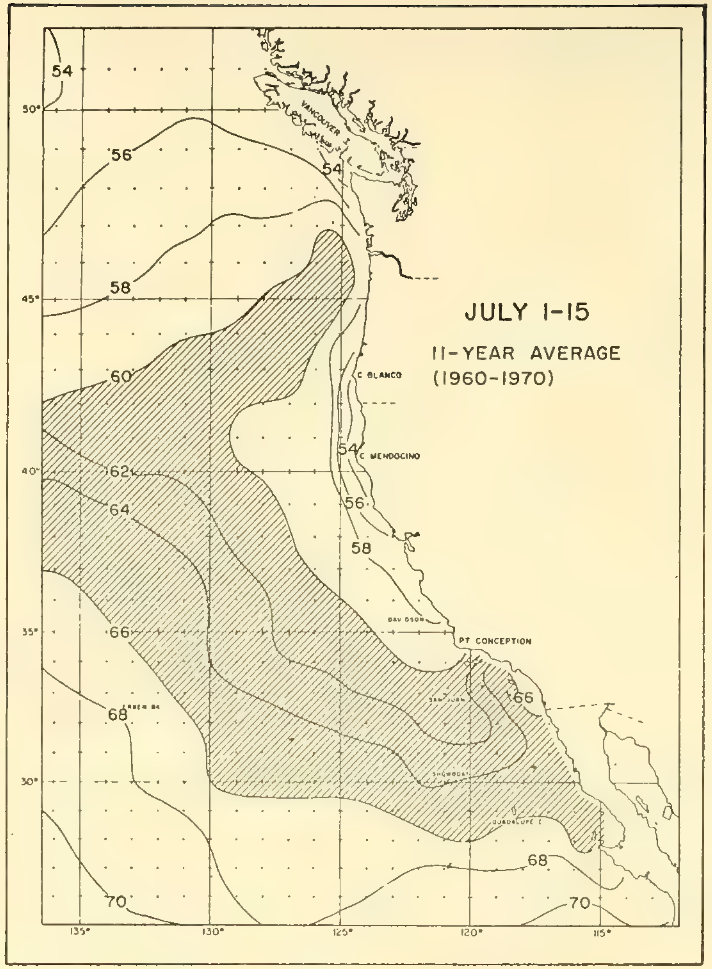


Fig. 1 - Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

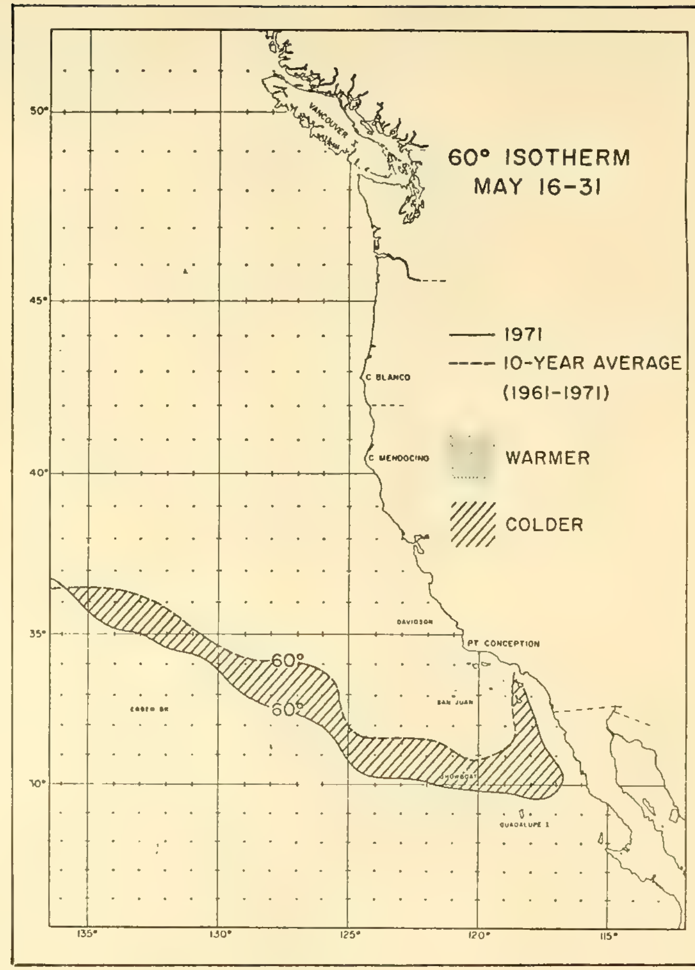


Fig. 2 - Relation of position of May 16-31, 1971, 60° F limiting isotherm to long-term average position for the same interval.

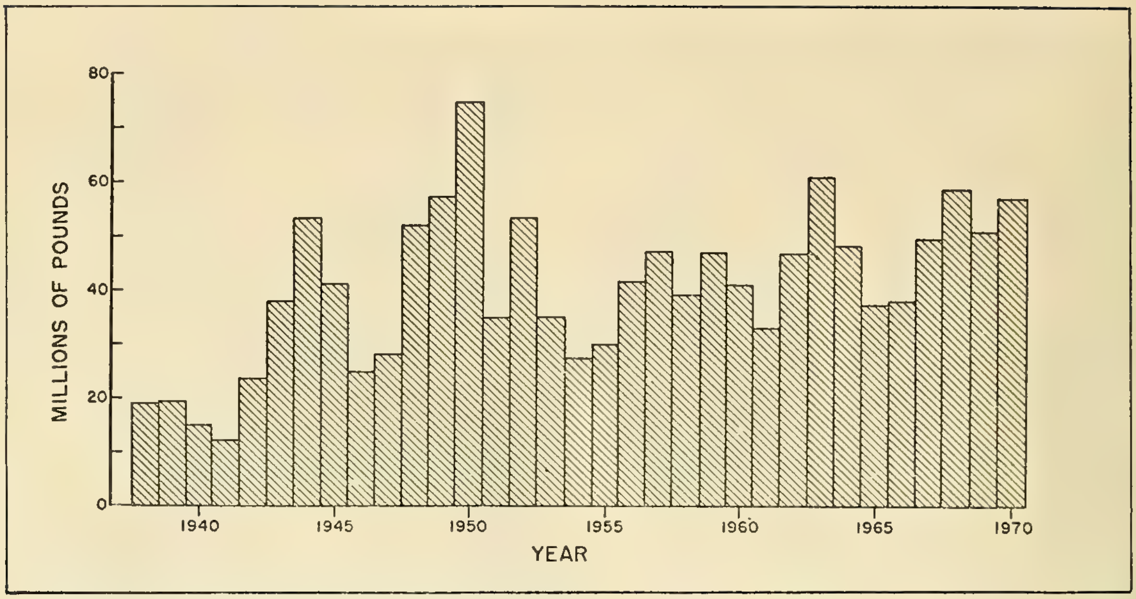


Fig. 3 - Total west coast landings of albacore tuna in millions of pounds, 1938-1970.

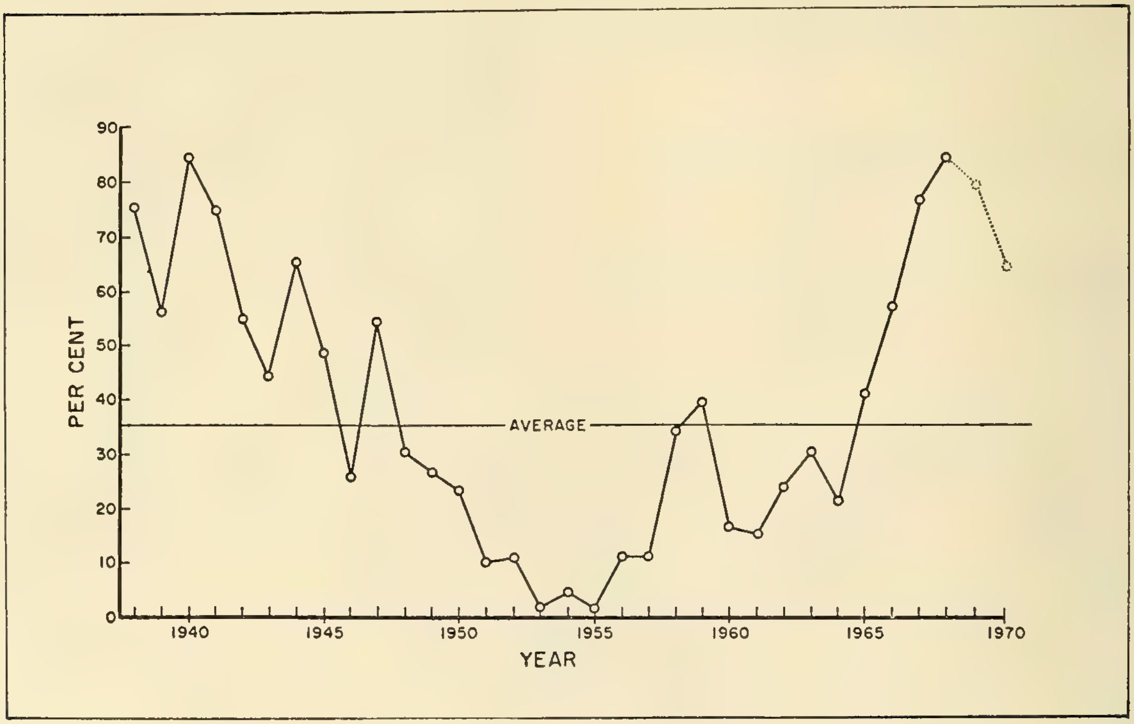


Fig. 4 - Percent of west coast albacore tuna catch taken north of San Francisco, 1938-1970.

HISTORICAL TRENDS IN CATCHES

Figures 3 and 4 give historical perspective to the albacore fishery. Figure 3 shows total landings of albacore tuna for west coast (U.S. and Canada) for 1938-70. Excluding 1938-41, the graph shows no significant trends in total landings. However, a decrease in year-to-year variability is evident in the later years. This graph does not reveal the effects of changes in fishing effort, availability, or fishing technology. In the last few years the catch has risen--but not in proportion to increase in effort and technology.

West coast landings for 1970 albacore season were 57.5 million pounds, higher than 1969 total (50.5 million pounds) and 1960-69 average (45.7). Probably, the higher 1970 landings reflect partly the increased fishing effort; although exact figures are not available, more boats fished albacore in 1970 than in 1969. At the same time, several jig-fishermen indicated their 1970 total catch was down 5 to 20% from 1969. More fishing effort is expected this year.

Figure 4 shows percentage of total catch north of San Francisco for 1938-70. The percentage north-south distribution of catch reflects large shifts in center of albacore fishery over past 30 years. An interesting and important aspect of the changes in percent distributions is that, year to year, these are small relative to long-term trends. The average year-to-year change is 13%; the largest year-to-year change is 27%.

BLUEFIN TUNA

In 1970, California bluefin landings were about 4,800 tons. These were the lowest in 17 years. In 1969, about 7,600 tons were landed. Average annual landings for 1957-68 are 10,900 tons; these include the record 17,400 tons of 1966.

ADVISORY OPERATIONS FOR 1971 SEASON

NMFS La Jolla will issue albacore advisory information throughout the season. The information will include sea-surface temperature charts, narrative albacore fish bulletins, and daily broadcasts of albacore fishing information over marine radio bands.

The Fishery-Oceanography Center at La Jolla will accept collect calls from fishermen at sea to report oceanographic, weather, and fishing information.

The telephone number is (714) 453-2820.

For more information about NMFS Albacore Advisory Information, contact:

Director
National Marine Fisheries Service
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037

COMMERCIAL FISHERMAN'S DIRECTORY AVAILABLE

A useful pocket-sized handbook for fishermen working off Pacific Northwest, the "Commercial Fisherman's Directory of Emergency Service," is available. It lists fish buyers and canners, medical facilities, motor and general boat repair companies, marine supply units, marine service stations, etc., for ports from Eureka, California, and north. It is a publication of the Pacific Sea Grant Advisory Program. It can be obtained free from: H.M. Dail, University of California Cooperative Extension, 1422 South 10th Street, Richmond, Calif. 94804.

THE FISHERMAN AND THE METRIC SYSTEM

The U.S. is the only major nation without plans to convert to the metric system. But it is being studied. In August 1968, Congress ordered the Bureau of Standards to study the system and make recommendations by August 1971.

Actually, the metric system has been legal in the U.S. for 105 years. Scientists, pharmacists, and others have long used the system. Many U.S. farm exports are sold by the metric ton (2,205 pounds) instead of the 2,000 pounds in the common weight. Some persons are advocating adoption of the metric system.

The Fisherman's Attitude?

Ernest D. McRae Jr., NMFS Woods Hole (Mass.) Exploratory Fishing and Gear Research Base, estimates it would take 10 to 40 years for fishermen to change from English pound system to French metric system.

Dr. J. Perry Lane, supervisory research food technologist, NMFS Gloucester, says average age of fishermen in Massachusetts area is 55 years. Change would come slowly.

The fisherman's charts list water depths in fathoms (6 feet); he hears that seas are running so many feet in wave height; visibility at sea is recorded in miles; wind speed comes in miles or knots per hour; his net's mesh size is measured in inches and his catch in pounds (especially in New England) or in tons (tuna).

Translating English into French may challenge Gloucester's school kids, who learn about the metric system, but observers are reluctant to predict that the average fisherman would embrace it warmly.

TAX REGULATION BENEFITS COMMERCIAL FISHERMEN

On June 9, the Internal Revenue Service and NOAA announced that those who lease commercial fishing vessels--and deposit money in a fund to buy, build, or rebuild such vessels--may file amended income-tax returns for 1970 if the money they deposit in the fund came from 1970 earnings.

Under a 1970 amendment to the Merchant Marine Act, eligible fishermen can agree with Department of Commerce to make such deposits. The law allows such taxpayers to reduce taxable income derived from operation of vessels covered under agreements by amounts of deposits.

How It Works

Even if a qualified taxpayer has not made such deposits, and his 1970 tax return has been filed, he may still enter into an agreement. Then he may file an amended return for a refund based on deposits into the fund.

To qualify, the taxpayer must act before Jan. 1, 1972, or within 60 days after final regulations are published, if this date is earlier. Deposits must be made within 60 days after agreement is executed.

To take advantage of new regulation, write to Director, National Marine Fisheries Service, Interior Bldg., Washington, D.C. 20235, for information.

BOSTON TO HOST FISH EXPO '71

Fish Expo '71, the 5th Annual American Fish Exposition, will be held at the Haynes Civic Auditorium, Boston, Mass., Wednesday through Saturday, Oct. 20-23, 1971.

The first expo of its kind in the U.S. was held in Boston during October 1967. Fish Expo '70 was held in Tampa, Fla., in October. Fishery industrial exhibits were displayed by organizations from 31 states and 9 foreign nations.

Information may be obtained from Fish Expo Headquarters, 3 School St., Boston, Mass. 02108.

NMFS HELPS GLOUCESTER FISHERMAN SWITCH FROM TRAWLING TO CLAM DIGGING

For about 40 years, Sam Favaloro, a ground fisherman in Gloucester, Mass., dragged for cod, whiting, haddock, and flounder. His father and grandfathers had fished before him. In recent years, it had become harder for Sam to make a living.

His attitude was reported by the New England Marine Resources Program:

"Faced with unreasonable competitive factors stemming from overfishing, foreign imports, fluctuating prices, foreign fishing boats poaching nearby fishing grounds, Sam came to realize that he would be unable to obtain an adequate living from the sea for his family of seven. His discouragement reached a high point last summer and fall when, after chasing for whiting, he returned to a seaport already overstocked with imports from South Africa and Argentina."

At that point, Sam was encouraged by scientists of the NMFS Gloucester laboratory. They urged him to investigate the ocean quahog (Artica islandica) as a developing resource for year-round fishing. The very abundant quahog is a potential substitute for the popular but disappearing surf and hard-shell clams. (See CFR, April 1971, p. 17.)

Back to Learning

Sam spent November and December 1970 learning about and digging for the "ocean" or "mahogany". Convinced that a potential market existed, he was the first to register his boat with NMFS for experimental research. On Jan. 4, 1971, he applied for a $5,100 grant to Economic Development Administration (EDA) in Washington, D.C., to prove that the close-at-hand quahog could keep fishermen in Gloucester. In late March, EDA approved grant. Contract signing by Sam, EDA, and NMFS would follow.

The Operation

There will be two 2-week expeditions. Sam and 2 helpers will dredge off Massachusetts under the NMFS flag. The NMFS Woods Hole Exploratory Fishing & Gear Research Base will outfit Sam's shrimp boat (a 50-footer with western rig). Ernest D. McRae Jr., assistant base director, reported that Sam will have latest experimental gear, including hydraulic dredge, air compressor to blow the water hose, and a 30-inch dredge pump and diesel. Sam will supply the boat, some rigging and a heavy mast, well-stayed with a fixed boom.

All data will become NMFS property.

On one trip, Sam will use only a "dry" dredge. Fishermen call this a "rocking chair". It is the one most commonly seen on small boats off New England. This mechanical dredge is small, box-shaped, and steel-slatted with steel teeth for digging into the mud as dredge is towed across ocean bottom. There are 8 to 24 teeth, depending on size of the dredge towed behind boat. It is brought in over the stern by booms and winches. McRae said one big drawback of the dry dredge is that clams often are broken and the meats are easily damaged.

Second Expedition

The second expedition's hydraulic dredge uses jets of water to loosen bottom sediments ahead of digging blade. The water jets create turbulence on the ocean bottom. This exposes clams in path of the blade that scoops clams into attached steel net. The jet hits the ocean bottom about 3 to 4 feet ahead of the blade. Water is supplied to the jets through a 6-inch hose attached to a powerful salt-water pump on deck.

The 40-inch-wide digging blade at mouth of dredge can be adjusted to various digging depths. An inclined rack passes shellfish into the dredge. Two steel frames or cages form bulk of the dredge and support the jet manifold, cutting blade, and mesh bag usually made of 3-inch metal rings or links. The cage slides along bottom on broad flat runners dragging the 8- to 12-foot bag.

McRae said a 40- or 48-inch dredge needs 1,600 to 1,800 gallons of water per minute--at about 60-pounds-per-square-inch differential pressure between inside of manifold and outside water pressure, regardless of depth. Normally, the dredge is towed against tide along bottom for 5 to 15 minutes, depending on density of clam bed. Towing speed varies from 4 to 6 knots per hour.

A hydraulic jet dredge alongside commercial vessel before being taken aboard for dumping. Catch has nearly filled chain bag.

The 1,000-pound dredge is lowered by the main winch and a $\frac{5}{8}$-inch wire cable attached to a ring on forward cage towing bar. After cage is filled, the dredge is raised to surface. A line is attached to a chain bridle on rear cage. This line is used to raise rear end of dredge above deck so it can be dumped.

Can Be Operated Easily

McRae said this type of hydraulic dredge is commonly used by fishermen to harvest clams and quahogs. He added: "The hydraulic dredge can be operated quite easily from small draggers or other small fishing vessels, although this method of dredging requires more accessory gear and is more expensive than a dry dredge."

McRae reported that his unit's latest modification in the hydraulic dredge method was getting rid of the diesel pump-and-hose arrangement. This was replaced with an electrically driven submersible pump mounted on a special steel plate. The plate is located across forward end of dredge under towing bar and braces. The 8-inch pump discharge is connected directly to manifold with a reducing elbow and a short length of 6-inch hose; this acts as precaution against shock and vibration. A neoprene-jacketed cable supplies power to pump. It is handled on a powered reel that can be mounted anywhere aboard ship. Although total cost of submersible pumping system is higher, the efficiencies are greater, McRae noted.

Another Modification

Another future modification eliminates mesh bag and enlarges after-cage. Now, clams are dumped onto a sorting table equipped with running water. Fishermen stand and sort, an onerous and leg-punishing job, which is going out, says McRae.

He would like to see a constant return system. Using this, the catch is brought onto deck without hauling in the dredge. Also, he would like to sée a complete preprocessing system on board ship. He noted that Soviets and others now operate such "factory" ships. These are equipped with preprocessing apparatus and refrigeration. "So this concept is certainly not new."

Ocean quahogs seem safe from Soviet exploitation because Soviets are bound by law not to dredge ocean bottoms.

McRae was optimistic about this: "Beds of clams that occur outside the contiguous fishing zone (3-mile limit) would probably be reserved for the American fisherman because the clams live within the bottom instead of over the bottom as do fish."

U.S. TO HOLD UP DISCHARGES INTO L. MICHIGAN UNDER 1910 STATUTE

Early in June, the Environmental Protection Agency (EPA) revealed that it would heed a relatively unknown 1910 Federal law and not grant permission to 7 heavy-industry firms to discharge waste into the southern end of Lake Michigan.

Chicago conservationist groups hailed EPA's decision. One of these groups, Businessmen for the Public Interest, had discovered the old law and informed EPA.

Refuse Act of 1899

EPA had planned to grant new permits for discharges into L. Michigan under Refuse Act of 1899. This act requires permission from U.S. Army Corps of Engineers, with EPA approval, before anything more can be dumped into navigable waters or their tributaries.

Earlier in 1971, Pres. Nixon had ordered a review of all existing permits. He directed EPA to renew these only if industry wastes had been purified enough to meet existing state and U.S. water-quality standards.

But the conservationist group argued that today's standards were much too low to prevent industrial discharges from seriously damaging lake. It maintained that permits that meet only present standards were only "licenses to pollute."

1910 Statute

The 1910 statute has been enacted specifically to protect southern end of L. Michigan. It banned discharge of any refuse from points along shore of Cook and Lake Counties--unless discharge is contained behind breakwater. No U.S. officer may authorize dumping contrary to this law.

1910 Statute Could Set Precedent

EPA's Administrator, William D. Ruckelshaus, said that 1910 Act could set precedent affecting future 1899 Act permits throughout U.S.

The EPA decision facilitates legal actions by conservationist groups to have the courts direct Cook and Lake County industries to change their disposal systems.

Challenge EPA's 1899 Permits

Businessmen for the Public Interest has filed suit in U.S. court challenging EPA policy on 1899 permits. The group wants the court to order EPA to require applicants for permits to instal the "most modern technology available" to clean their discharges instead of just meeting present water-quality standards.

Illinois Action

The Illinois Pollution Control Board was working to adopt more stringent standards for all State waterways. It planned to single out L. Michigan for special protection through new standards.

7 Large Companies

Use of the 1910 statute affects 7 of largest industrial firms along lake's southern shore: Inland Steel, U.S. Steel, American Maize Produce, American Oil, Union Carbide, Commonwealth Edison, and Northern Indiana Public Service.

Appeal to Atomic Energy Commission

The Businessmen for the Public Interest called on Dr. Glenn T. Seaborg, Atomic Energy Commission chairman, to ban new construction permits for nuclear power plants. It asked too that he close 11 of those already operating in U.S. until new emergency cooling systems have been designed.

The conservationist group reminded Dr. Seaborg that AEC's own studies showed present emergency cooling systems might not prevent catastrophic atomic discharge if break occurred in a reactor's normal cooling system.

U.S. & CANADA AGREE TO END GREAT LAKES POLLUTION BY 1975

Meeting in Washington on June 10, the U.S. and Canada agreed on a common program to end Great Lakes water pollution by 1975.

The $2-billion program's object is to produce over the next 4 years waters "clean enough for any fish to live in."

Unprecedented Scope

Russell E. Train, chairman of Environmental Protection Agency, described agreement as "historic first." He stated that its provisions were "unprecedented in scope" and could be model for international agreements everywhere.

Canada's Sharp

Mitchell Sharp, Canada's External Affairs Minister and a former fishery minister, noted that agreement was the "most far-reaching ever signed by 2 countries in environmental field."

Sharp had pointed out earlier that Great Lakes pollution had reached level where "two of the richest societies on earth are knowingly and wantonly poisoning this unique resource, and by extension, each other."

18-point Communiqué

At end of meeting, an 18-point communiqué announced U.S. & Canada would set up and carry out "common water quality standards" for Great Lakes and St. Lawrence River.

They agreed to conclude before end of 1971 an executive agreement on water-quality control to embrace these programs:

- Build treatment facilities for municipal and industrial wastes and animal husbandry operations.
- Reduce phosphorus discharges.
- Eliminate mercury and other toxic heavy metals from discharges.
- Control thermal, radioactive waste, and pesticide pollution.

The Cost

Implementing these controls is expected to cost U.S. about $2 billion over next 4 years--half paid by U.S., the rest by State and local governments.

Sharp said he did not know exact cost to Canada, but that it would run to "hundreds of millions of dollars." Canadian share is far less because industrial development on north shore of lakes is less advanced.

Combat Oil Spills

U.S. & Canada will coordinate steps to combat oil spills in Great Lakes. A joint response center will be activated when major spills occur.

The 2 countries will adopt compatible rules for ship designs and construction to prevent spills.

International Joint Commission

U.S. & Canada will enlarge authority of International Joint Commission. This body was set up under 1909 treaty. It has been studying for 6 years pollution problems in Lake Erie, Lake Ontario, and parts of the St. Lawrence that forms international boundary.

1970 U.S.-CANADA GREAT LAKES COMMERCIAL FISHERY FELL 10%

In 1970, the Great Lakes catch by commercial fishermen of the U.S. and Canada was 110.5 million pounds worth $11.7 million--a drop of 10.5% in weight and about 3% in value.

U.S. landings rose from 67 million pounds in 1969 to 70.4 million in 1970, but the increase was due principally to a larger alewife harvest in Lake Michigan. Last year, production in lakes Erie, Huron and Superior dropped to record lows.

The Canadian decline from an all-time high of 56.5 million pounds in 1969 to about 40.1 million in 1970 was caused primarily by a sharp drop in catch of yellow perch and smelt in Lake Erie. These two species were a little under 80% of total Canadian Great Lakes catch in 1969 and 73% in 1970. Another factor was the ban on commercial fishing in Lake St. Clair (permitted only in Canadian waters) in early April 1970 following discovery of substantial mercury contamination.

The 1970 data come from National Marine Fisheries Service office in Ann Arbor, Mich., and from preliminary statistics of Ontario Department of Lands and Forests.

The catch in waters of the Great Lakes states in 1970 was (in 000s of pounds):

Illinois	405.2	New York	533.6
Indiana	334.6	Ohio	8,420.0
Michigan	21,168.8*	Pennsylvania	505.5
Minnesota	1,306.5	Wisconsin	37,714.8*

*Alewives: Michigan 5,981.4; Wisconsin 27,478.7.

LAKE MICHIGAN

The lake's share of U.S. Great Lakes fishery production was 75% of 1970 total. Due to major role of low-value alewife--used for fish meal, oil, and pet food--the lake's share of catch value for all U.S. waters was 60%.

The 33.5 million pounds of alewives in 1970 was second only to 1967 record of 41.9 million pounds; in 1970, alewife was 48% of U.S. Great Lakes catch.

Lake Michigan also provides a large share of U.S. production of chubs and lake whitefish, the most valuable commercial species in U.S. section of Great Lakes. In 1970, the 9.6 million pounds of chubs and 1.7 million pounds of lake whitefish were 21% of total lake catch; their landed value of $2.7 million was 71% of receipts for all species. The whitefish catch was highest for lake since early 1950s.

Lake trout, the high-value species nearly eliminated by sea lamprey, provided a commercial catch of over 87,000 pounds in 1970, the greatest since restocking of this species began in Lake Michigan in 1965.

The coho salmon, first planted in Lake Michigan in 1966, has won an important place in lake's commercial and sport fishery. In 1970, the coho available to commercial outlets reached a record 2.2 million pounds. To a large degree, the fish marketed are bought from surplus stocks taken by Michigan's fishery agency during heavy fall spawning runs. This procedure permits use of huge number

of coho that cannot be taken by any sporting method--and would otherwise die in the streams after spawning.

	1969	1970	1969	1970
	(000 lbs.)		(000 $)	
U.S. total	66,968	70,389	5,968	6,338
Lake Ontario	294	333	44	79
Lake Erie	11,050	9,546	1,428	1,265
Lake Huron	2,897	2,411	493	404
Lake Michigan	47,489	53,091	3,028	3,819
Lake Superior	5,239	5,009	975	771
Canadian total	56,496	40,131	6,128	5,391
Lake Ontario	2,270	2,905	330	429
Lake Erie	48,026	31,722	4,244	3,769
Lake St. Clair	919	87	332	41
Lake Huron	2,329	2,120	819	734
Lake Superior	2,951	3,297	403	418
U.S.-Canada total	123,464	110,520	12,096	11,729

LAKE ERIE

Although Canadian landings dropped one third from 1969 to 1970, the 31.7 million pounds in 1970 were 77% of lake total. In 1969, the Canadian share was 81%. U.S. 1970 production for the 4 states bordering Erie was a new low of 9.5 million pounds, less than half the catch in 1961 and 1962.

In Canadian catch, yellow perch and smelt are dominant species--together 93% of 1970 Erie total. For yellow perch, a strong 1965 year-class was prime factor in 1969 record catch. But hatches after that have been weak to fair. So fade-out of 1965 class was reflected in 1970 landings. The high Canadian smelt catch of 1969 was dominated by a large 1967 hatch, which has not been repeated.

LAKE HURON

Commercial 1970 landings by U.S. and Canadian fishermen--about 4.5 million pounds--hit an all-time low. The downward trend results from the decline of several species. However, the Canadian catch of lake whitefish gained a fraction and reached nearly a million pounds, highest since 1960.

	Pounds				Dollar Value			
	1969 (000s)	% of Total	1970 (000s)	% of Total	1969 (000s)	% of Total	1970 (000s)	% of Total
U.S. total	66,968	100	70,389	100	$5,968	100	$6,338	100
10-species	63,513	95	66,927	95	5,156	86	5,621	89
Alewives	29,248	44	33,461	48	332	6	381	6
Chubs	10,156	15	10,934	16	1,550	26	1,842	29
Carp	6,507	10	6,582	9	266	4	397	6
Yellow perch	4,905	7	4,271	6	677	13	761	12
Smelt	3,614	5	3,555	5	116	2	96	2
Whitefish	2,323	3	2,352	3	1,412	24	1,331	21
Coho salmon	1,144	2	2,243	3	39	1	315	5
Lake herring	2,321	3	1,364	2	296	5	170	3
White bass	1,221	2	1,103	2	365	6	275	4
Sheepshead	2,074	3	1,060	1	103	2	53	1
Canadian total	56,496	100	40,131	100	$6,128	100	$5,390	100
5-species total	50,205	89	35,463	88	4,776	78	4,795	89
Yellow perch	30,468	54	21,241	53	3,313	54	3,419	63
Smelt	15,226	27	9,571	24	561	9	437	8
Lake herring	2,453	4	2,857	7	195	3	232	4
Whitefish	1,142	2	1,233	3	621	10	639	12
Carp	916	2	561	1	86	1	69	1

LAKE SUPERIOR

The 1970 catch was 8.3 million pounds, only slightly above 1969's 8.2 million, lowest figure since 1900. The 1970 catch was a record low for U.S. waters. The major factor in Superior's decline has been the sharp drop in U.S. landings of lake herring. The annual catch has decreased steadily from about 11.5 million pounds in 1961 to about 1.3 million in 1970. Smelt production in U.S. waters was 1.6 million pounds in 1970. For first time, it became leading species in Superior catch.

LAKE ONTARIO

Commercial landings in 1970 were 3.2 million pounds, the greatest since 1941 (3.7 million). The major part of lake's catch is taken in Canadian waters. A prime factor in 1970's gain here was the increase in yellow perch landings; the 1970 figure of nearly a million pounds were more than double 1969's. This gain was stimulated partly by a rise in sale price, which spurred fishing effort.

LAKE ST. CLAIR

Commercial fishing is limited to Canadian waters. In recent years, the annual catch has ranged from about 800,000 to 1 million pounds. However, in 1970, the discovery of mercury in St. Clair waters closed fishery early in the year; production was only 87,000 pounds.

OCEANOGRAPHY

NAVAL OCEANOGRAPHIC OFFICE CUTS GUESSWORK IN SEDIMENT STUDIES

The U.S. Naval Oceanographic Office (NOO) has eliminated much guesswork in investigating sediment deposits in harbor and coastal areas by using a special survey instrument. This was reported by Captain F. L. Slattery, NOO Commander.

The device is a high-resolution, high-frequency seismic profiler. It has been used successfully aboard small survey craft to measure the thickness and extent of subsurface layers.

How It Works

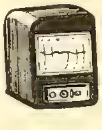
The instrument, said Newell Stiles, who directed the trials, generates continuous wave fronts on frequencies of 5 and 12 kilohertz. It records the time required for the sound pulse to travel through the water and the sediment cover. It plots these travel times automatically to produce cross-sectional outlines. These are coordinated with precise positioning data to make contoured maps.

Stiles noted: "As the wave fronts encounter materials of contrasting acoustic impedance (in the sediment cover), portions of the transmitted sound are returned, in the form of echoes, to the (water's) surface where they are sensed by the profiler's transducer. The materials of contrasting acoustic impedance are normally manifestations of geologic stratification or boundaries."

Contoured Maps Made Quickly

He said contoured maps showing thickness of muds and clays between the boundaries can be constructed easily in the field. The maps can be forwarded immediately to ocean scientists studying sediment cover.

The maps can eliminate the need to initiate tight survey patterns, the present method for adequately charting sediment deposits.



WATER-CIRCULATION STUDIES AID POLLUTION CONTROL

NOAA is conducting a detailed 2-year study of the dynamics of water circulation in Boston Harbor and Massachusetts Bay. It is part of a larger NOAA program of similar studies in coastal and estuarine waters.

The survey will provide necessary data for pollution-control authorities to maintain and preserve the marine environment. The latest information on current speed and direction in the Boston Harbor area also will contribute to navigation safety.

NOAA's National Ocean Survey's 'Ferrel' is being used.

Ferrel's Gear

The Ferrel's primary means of observing currents is the TICUS (Tidal Current Survey). The system, which is being used extensively in the program, employs current meters suspended from buoys at preselected stations throughout the Boston Harbor area. Observations of the current's speed and direction at various depths at each station are recorded for study by the National Ocean Survey at Rockville, Md.

Also, scientists are using a photographic recording current meter to record on 16 mm film the current's speed and direction. Other instruments include sensors for observing water temperature, salinity, and depth.

The survey results will appear in two National Ocean Survey publications.

NOAA has scheduled circulation studies of the entire coastal area from southern Maine to Rhode Island during the next 3 to 5 years.

NOAA SUPPORTS SALT-MARSH RESEARCH IN GEORGIA

NOAA has awarded a $216,700 Sea Grant to the University of Georgia to study the use and conservation of salt-marsh estuaries in Georgia. Part of the program will be conducted by the Skidaway Institute of Oceanography at Savannah.

There is a real need for salt-marsh ecological and utilization studies. For about a hundred years, the Georgia coastal region, except around Savannah and Brunswick, has had a low population and very little development. As the timber-and-plantation economy diminished, then died, many sea islands returned to a wild state.

A Period of Change

The status of the coastal region has been changing rapidly in recent years. Certain sea islands have been bought by or donated to the U.S. or Georgia. Planning for other islands and close-in areas includes resort development, strip-mining sites, and mariculture. A nuclear power plant is being built. Coastline and estuarine development is gathering momentum--yet there is little information on the effects changes might have on organisms and other resources within the marshes.

What Scientists Will Study

Scientists will investigate the natural and biological factors affecting growth and reproduction of marsh organisms, and the economic potential of salt marshes. Diseases that affect man's use of estuarine species will be studied. The scientists will monitor 4 finfish and 4 shellfish species and examine them for pathogenic microorganisms and parasites.

Using existing findings by NMFS and fishermen, the researchers will try to increase fishery production. They will focus on abundant fish species off Georgia that are not being fully used.

SATELLITES MEASURE SEA-SURFACE TEMPERATURE IN U.S.-MEXICO SURVEY

The results of a U.S.-Mexican oceanographic survey, LITTLE WINDOW II, are expected to tell scientists how accurately two meteorological satellites--NOAA I and ITOS I--can measure changes in the ocean's surface temperature and monitor the weather. This was reported by Rear Admiral W.W. Behrens Jr., Oceanographer of the Navy.

LITTLE WINDOW II was an oceanographic survey of a 100 by 100 mile square in the Gulf of California. It tested the ability of infrared sensors aboard the NOAA and ITOS satellites to measure the ocean's surface temperature from space.

U.S.-Mexico Survey

LITTLE WINDOW II was larger than a survey in the same area in March 1970. During early May 1971, U.S. and Mexican scientists used 3 specially equipped research aircraft and 5 survey vessels to run oceanographic transects of the window region. The temperature information will be compared with infrared readings collected simultaneously by the satellites during their twice-daily passage over the area.

Participating in this cooperative venture were Mexico's Navy and Instituto Nacional de Pesca; the Inter-American Tropical Tuna Commission; and FAO.

The U.S. Naval Oceanographic Office (NOO) coordinated LITTLE WINDOW II. Cooperating were NOAA's National Marine Fisheries Service, National Environmental Satellite Service, National Weather Service, and National Oceanographic Data Center; NASA and its Ames Research Center; and Scripps Institution of Oceanography.

Gulf of California Unique

NOO says the Gulf of California is uniquely suited for this type of experiment. It has an extremely dry atmosphere with a minimum of clouds, land masses distinctive enough to position spacecraft results within desired oceanographic tolerances, and a fairly uniform sea-surface temperature.

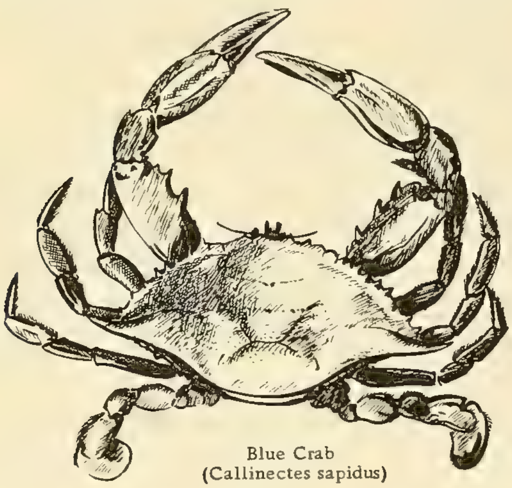
Significant If Successful

LITTLE WINDOW's success would show that satellites can provide continual sea-surface temperature for any ocean. Such information would be very helpful: to fishery scientist to predict distribution of temperature-oriented fish, such as tuna; to meteorlogist, who studies warm and cold ocean fronts and their relationships to short-period meteorological changes and seeks reliable long-range weather forecasts; to oceanographer searching for a quick way to look at temperature conditions over broad sea surfaces. The meteorological and water-mass condition implications are especially interesting to the Navy.

CHESAPEAKE BAY HARD CRABS WILL BE SCARCE THIS SUMMER

Hard crabs will be scarce in the Chesapeake Bay until August, say scientists of the Virginia Institute of Marine Science (VIMS), Gloucester Point, Va. They conduct regular surveys of blue-crab stocks. They predict the crab-pot and trotline catch this summer will be 8 to 10 million pounds, near the lowest since 1960.

The average catch from June through August over the past 11 years was 16 million pounds. The average was exceeded in 7 of the 11 years; in 4 years, the catch was below average. The largest landings, in 1967, totaled almost 22 million pounds; the smallest was 8.5 million pounds in 1969.



Blue Crab
(Callinectes sapidus)

Present Crabs Hatched in 1969

The crop of commercial-sized crabs now available was hatched in 1969. Routine surveys of some Virginia rivers revealed few small crabs in fall 1969. The crop failure was believed caused by heavy rains during August 1969. Low supplies of the 1969 hatch were reported by VIMS in spring 1970 and again in the fall. The summer scarcity was expected.

The scientists add an optimistic note: there should be many soft crabs and peelers this summer, possibly more than at any time during the last 10 years. These crabs, hatched in 1970, will produce the bulk of the commercial hard-crab catch from September 1971 through August 1972.

VIMS STUDIES INCREASING PRODUCTION OF SOFT BLUE CRABS

A NOAA Sea Grant is enabling scientists of the Virginia Institute of Marine Science (VIMS), Gloucester Point, Va., to study methods of increasing soft blue-crab production in the Chesapeake Bay.

Soft crabs for food and peeler crabs for fishing bait have high public demand--but are only a small part of total blue-crab landings in Chesapeake Bay.

The 10-Year Record

During the past 10 years, an annual average of 3.5 million pounds of soft and peeler crabs were produced worth $1.2 million. Although these landings were less than 5% of the bay catch of crabs, they earned 20% of the dollars.

Records show fluctuations in hard and soft crab production, says Paul A. Haefner Jr., marine scientist in VIMS Crustaceology Department. The dollar value of hard crabs remains fairly constant; that of soft crabs varies according to number produced. Although dollar value of hard crab fishery exceeds that of soft crab, the latter is worth more per pound.

Haefner noted that if more soft and peeler crabs were taken, there would be fewer crabs to become mature hard crabs--but income from soft crabs would increase without changing markedly the value of hard crabs.

Adequate supplies of peeler crabs are available for harvesting. What has kept production of soft crabs at low levels has been absence of guidelines for efficient construction and maintenance of holding facilities.

Sea Grant Project's Aims

Haefner said the primary aim of the VIMS Sea Grant project is development of plans for physical plants for shedding crabs in tanks with open-flow or recirculated sea water. The scientists also will establish guidelines for acceptable levels of water quality, and for the condition and quantity of crabs that can be handled. Another project aspect is the study of crab mortality and, perhaps, ways to prevent this loss to industry.

HARD CLAM CLEANSING IN NEW YORK

Robert B. Mac Millan and James H. Redman

The State of New York (NY) has approximately 400,000 acres of underwater marine lands suitable for the cultivation of shellfish. Thirteen percent of this area is closed to the harvesting and marketing of shellfish due to microbial pollution. Many of these areas, including Jamaica Bay, Raritan Bay, Manhasset Bay, Hempstead Harbor and portions of Long Island Sound lying within Westchester County, support abundant populations of hard clams (Mercenaria mercenaria). These shellfish constitute a natural resource which is not being utilized and a public health menace if harvested and marketed illegally.

Interest and concern have been expressed by Federal and state regulatory agencies and members of the shellfish industry to exploit these areas. As a result, the N.Y. Department of Environmental Conservation initiated a transplant program in 1964: shellfish were removed from closed areas and placed in certified waters for a minimum of 30 days to achieve purification. An alternate process known as depuration offers purification under more stringent controls. Although the general concept of this process is not new, only limited laboratory data have been accumulated relative to the effectiveness of this process in cleansing hard clams.

New York initiated a study in 1964 to gather data for proper evaluation of a hard-clam commercial depuration plant operation. Following the preliminary investigations, funding was obtained in 1965 from the Bureau of Commercial Fisheries (BCF) under Public Law 88-309 to conduct a pilot-plant study of the depuration of hard clams.

Pilot Plant for Hard-Clam Depuration

The depuration plant has four essential components, including controlled dry storage for untreated and treated shellfish; depuration tanks; and sea-water treatment. Office and laboratory facilities are optional depending on a particular situation. A typical plant layout is shown in Figure 1.

The pilot plant was located on the Great South Bay at West Sayville. Great South Bay is located on the south shore of Long Island (Figure 2) and is a highly productive area with 1969 commercial landings of 6,280 million pounds of hard clams valued at $6,850,000. This site had been used in the initial 1964 studies. However, several modifications had to be completed prior to the operation of the plant.

A boiler-burner combination and heat exchanger were installed with the assumption that raw sea water taken from the bay would require a significant amount of heating for winter operations. The hard clam ceases to feed with water temperatures below 45 degrees Fahrenheit (^{o}F). The recommended water temperature for the depuration process is 59^{o} F. Since the water temperature for Great South Bay approaches 30^{o} F. during the winter months, a 29^{o} F. increase would be required prior to use in the system.

The clam holding tanks were redesigned and rebuilt to improve the flow of water through the system. Three tanks, each 9.1 feet long, 9.7 feet wide, and 1.375 feet deep, were built with sea water entering each tank at the rate of 20 gallons per minute (GPM).

Two settling tanks also were built adjacent to the holding tanks. Initial plans were prepared on the premise that sea water for the system would be drawn from Great South Bay. Since this water normally contains high levels of suspended particulate matter, the settling tanks were planned to remove this material prior to passage through the heat exchanger and sea-water sterilization units.

Mr. Mac Millan is Assistant Sanitary Engineer and Mr. Redman Senior Aquatic Biologist (Marine), N.Y. State Department of Environmental Conservation, Division of Marine and Coastal Resources, 4175 Veterans Memorial Highway, Ronkonkoma, N.Y. 11779. The study was conducted in cooperation with the Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service under Public Law 88-309, Project 3-68-D. Contribution No. 71-3, Division of Marine and Coastal Resources.

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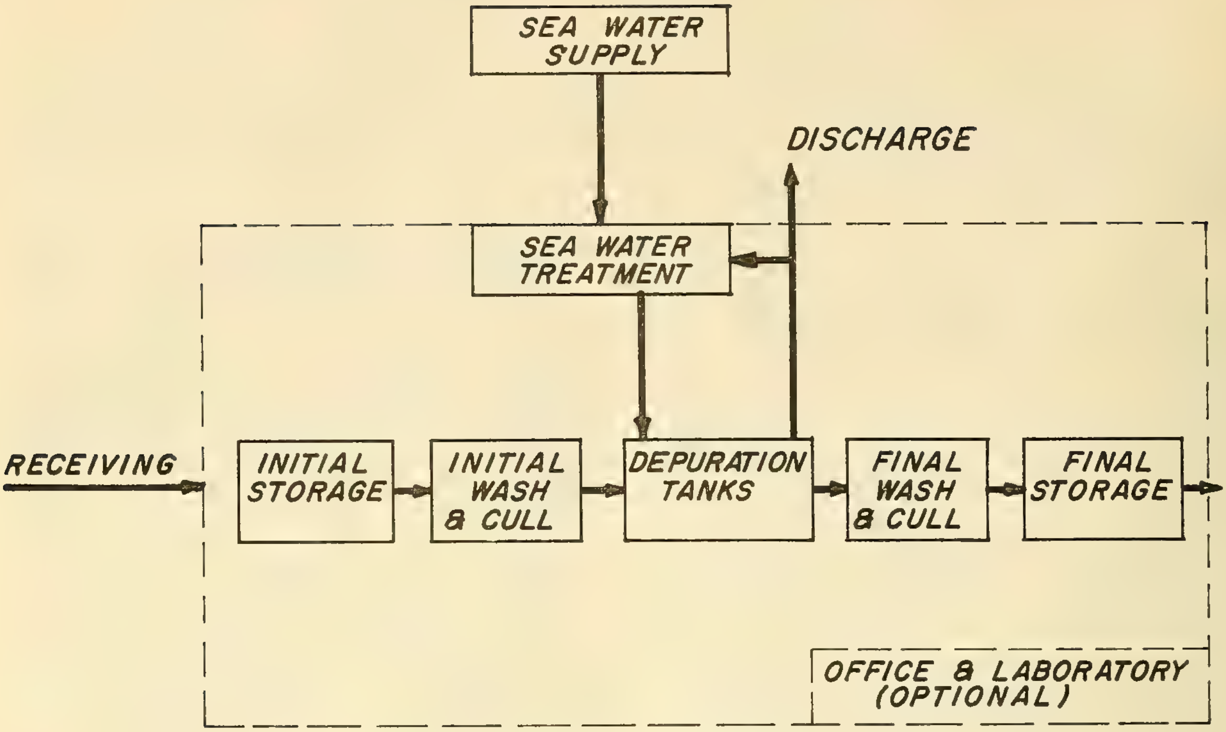

Fig. 1 - Schematic diagram of a depuration plant.

A sea-water well was installed as a supplementary water supply for the operation of the plant. Figure 3 shows the plant arrangement used throughout the test program.

Sea-Water Well System

Four experimental wells were driven. Each consisted of a 12-inch slotted point coupled to 5-foot lengths of 1.25-inch galvanized pipe. At each well site, water samples were collected at 5-foot intervals and analyzed for salinity and temperature.

Following the completion of each well, a centrifugal pump was connected to the system and operated for approximately 1 hour to determine flow characteristics and water quality at each site. A brief summary of the average data obtained at the four sites follows.

Summary of Experimental Well Point Data	
Pumping Rate	- 30 GPM.
Water Temperature	- 54.5 - 55.5° F.
Salinity	- 24.0 - 25.5 parts per thousand (°/oo).
Bacteria/milliliter (ml)	- None readily detectable.

NOTE: These data are summarized from a well point depth range of 20 to 50 feet below tidal water level.

As a result of these data, a 4-inch-diameter well was installed in the plant adjacent to the settling tanks. This system included a 4-inch-diameter stainless steel intake screen, 10 feet in length, coupled to 35 feet of 4-inch-diameter steel well casing.

The pumping rate for this system of approximately 225 GPM was reduced by inserting a 2.5-inch diameter polyvinyl chloride (PVC) pipe inside the steel well casing and perforating the lower 6 inches of this pipe with 0.25-inch diameter holes. The flow rate was further controlled by the addition of a 2.5-inch diameter ball valve located on the discharge side of the pump. The final installation is shown in Figure 4.

The well proved to be extremely effective and offered several important advantages when compared to drawing sea water from Great South Bay. The advantages include:

1. Constant salinity.

2. Constant temperature year round.

3. Elimination of heating requirements for the water.

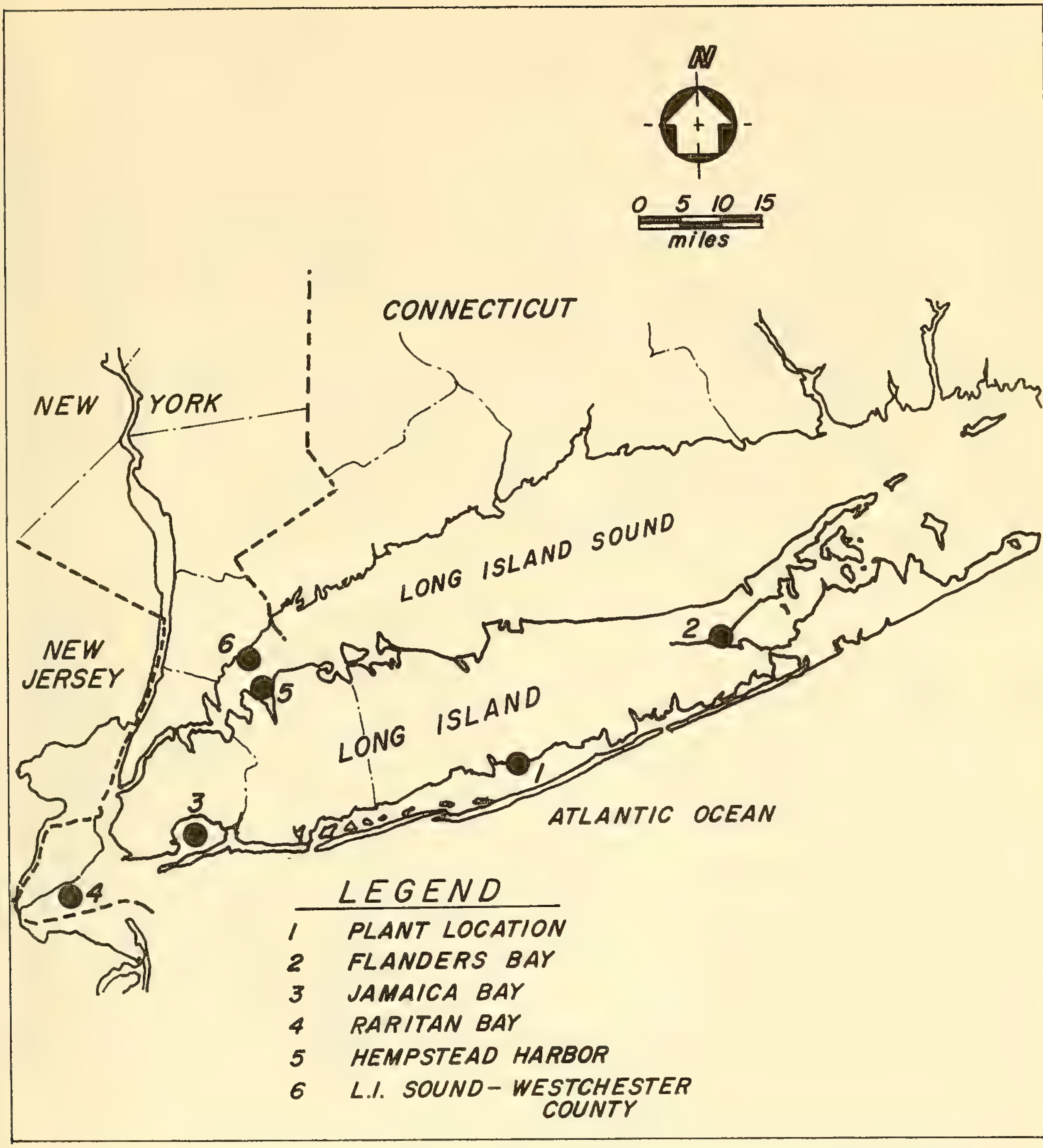

Fig. 2 - Location of New York State Depuration Plant and areas where hard clams were harvested.

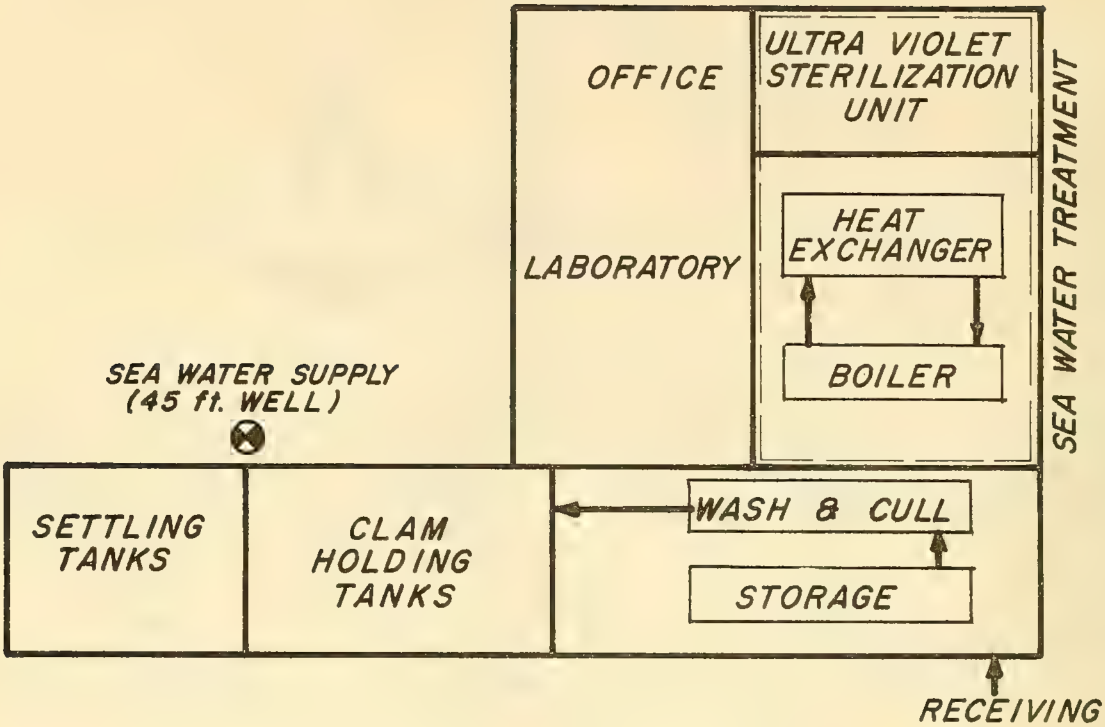

Fig. 3 - Layout of the New York State Depuration Plant.

4. A minimum amount of ultra-violet sterilization since the well water is practically free of detectable bacteria.

5. Elimination of fouling organisms and growth within the sea water distribution lines because these organisms are removed by natural sand filtration.

6. Elimination or reduction of settling tanks since no suspended matter is present.

Operation of the Depuration Plant

Following the completion of modifications on the depuration plant, a series of 42 experiments was conducted. Lot sizes varied from 5 to 45 bushels of hard clams per experiment, depending upon the availability of clams.

Hard clams for the experiments were obtained from several growing areas, including portions of Flanders Bay, Jamaica Bay, Raritan Bay, Hempstead Harbor, and portions of Long Island Sound lying within Westchester County.

The initial step in the pilot-plant operation required a prewash and cull of the clams before loading them into baskets. This operation is necessary to remove foreign matter attached to the shellfish that might impair water quality in the holding tanks. The operation was performed using a mechanical clam washer similar to that designed by the State of Maine for use in the soft clam (Mya arenaria) industry. The washer consists of a chain link conveyor belt and a series of spray nozzles to remove mud or other matter that might be attached to the shellfish. Following a high pressure spray, injured shellfish and other debris are removed from the belt. It should be noted that the design of this particular washer must be modified for use with the hard clam. The hopper portion of the washer uses an inclined plane, which is too steep for hard clams (see Figure 5).

After the prewash, the clams were loaded in baskets 20 inches long, 18 inches wide, and 6 inches deep. The baskets were made of wire coated with plastic (PVC) and held one-half bushel when filled to a depth of 3 inches. The shellfish were placed in the shellfish holding

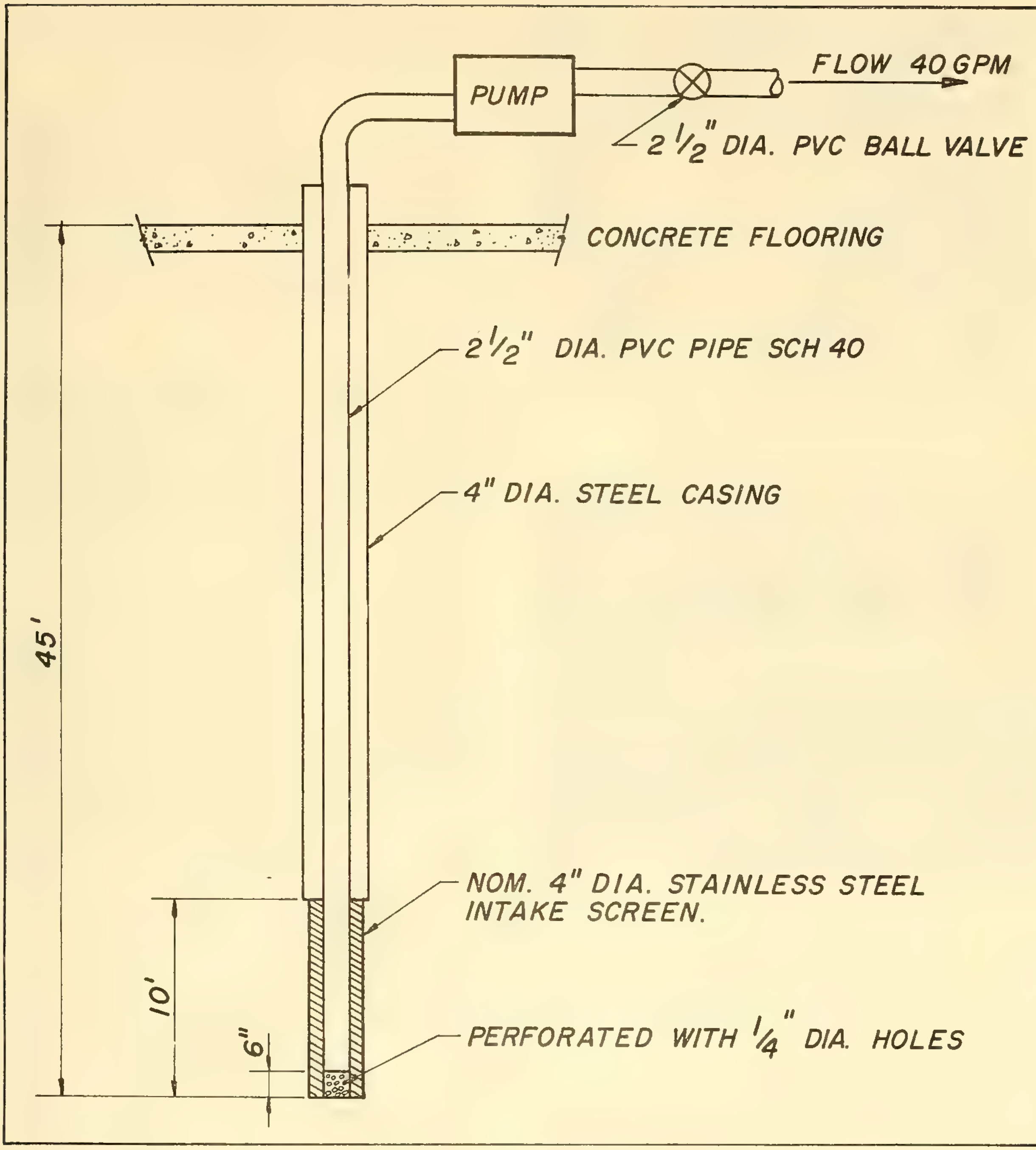

Fig. 4 - The sea water well system.

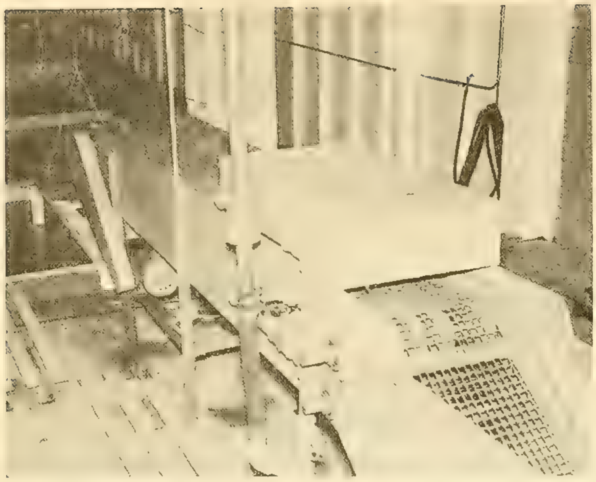

Fig. 5 - Mechanical clam washer used to remove muds and detritus from clams prior to loading in clam tanks.

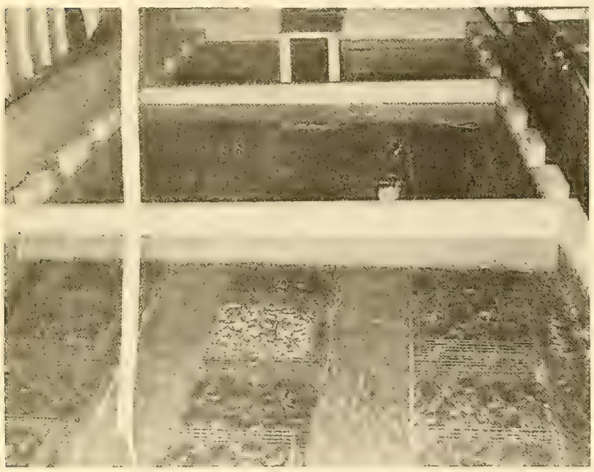

Fig. 6 - Depuration tanks with clams loaded in plastic coated baskets.

tanks in three separate rows perpendicular to the flow of water and stacked two baskets deep (see Figure 6). The holding tanks were designed for a capacity of 15 bushels of hard clams each.

Zero hour for each experiment was recorded as that moment when water was observed flowing over the exit weirs of the holding tanks. At this time, a zero-hour sample of clams was collected for bacteriological examination. A second sample was collected at 24 hours and a final sample at 48 hours. These samples were to determine the degree of purification achieved during each experiment.

Depuration and the Public Health

Since the purpose of depuration is to obtain shellfish free of bacterial and viral pathogens, it is desirable to search for these organisms during the purification process. Unfortunately, this is impractical. Currently available laboratory methods may require from days to weeks to obtain results. Therefore, as with milk, water, and most foods, sanitary indicator bacteria are used.

Sanitary indicator bacteria are usually microorganisms which normally inhabit the intestinal tract of warm-blooded animals and are excreted in large quantities with the feces. There presence in foods may indicate fecal pollution and contamination with pathogens. The indicator bacteria have a notable safety feature. They are almost invariably more numerous in the feces and the environment than the pathogens.

In shellfish sanitation, much emphasis is placed upon fecal coliforms as bacterial indicators of dangerous contamination. These organisms have the rare capacity of being able to ferment lactose with gas production when incubated at 44.5° Celsius ($^{\circ}$C) for 24 hours. The usual procedure (American Public Health Association, 1962) for enumerating fecal coliforms in shellfish requires 3 days. The use of this test could delay the marketing of depurated shellfish until evidence of their safety is obtained. To minimize this delay, we adopted a pour plate procedure, with a modified Mac Conkey Agar[1], (Cabelli and Heffernan, 1966) which offers results within 24 hours.

Our monitoring practice was to collect 12 clams at 0, 24, and 48 hours depuration process time. Each 12-clam sample was shucked as aseptically as possible into a sterile food blending jar and homogenized for $1\frac{1}{2}$ minutes. Ten milliliters (ml) (approximately 5 grams) of the homogenate were pipetted into a screw-capped test tube containing 100 to 120 ml of the modified Mac Conkey Agar. The tube was gently inverted several times to insure adequate mixing and the contents distributed among 6 Petri plates which were incubated in

[1]Ingredients, modified Mac Conkey Agar: Gelysate, 17.000g; Polypeptone, 3.000g; Lactose, 10.000g; Bile Salts #3, 0.750g; Agar, 13.500g; Neutral Red, 0.30g; Crystal Violet, 0.001g; Sodium Chloride, 5.000g; Distilled Water, 1000ml.

Table 1 - Fecal Coliform Colony Forming Units per 100 grams for Hard Clam Samples collected during the Depuration Process

Date Trial Initiated	Process Time In Hours	Fecal Coliform CFU/100 g.
7-9-68	0	1000
	24	120
	48	20
7-15-68	0	2500
	24	<20
	48	<20
7-22-68	0	320
	24	20
	48	<20
8-6-68	0	5100
	24	100
	48	<20
8-6-68	0	200
	24	<20
	48	<20
8-13-68	0	180
	24	20
	48	<20
9-11-68	0	460
	24	40
	48	<20
9-18-68	0	200
	24	20
	48	<20
9-25-68	0	140
	24	20
	48	<20

CFU = COLONY FORMING UNITS.

an air incubator at 45° C. for 24 hours. Fecal coliform colonies[2] were totaled for the six plates, multiplied by 20, and reported as Fecal Coliform Colony Forming Units per 100 grams of sample. Results of 9 hard clam depuration trials are included in Table 1.

Bacterial monitoring of hard clam depuration is most successful during the warm months. Hard clams harvested in December, January, February, and March are practically free of fecal coliforms, regardless of the water quality of the growing area.

When sea-water temperatures fall below a certain value, the clams cease feeding and accumulating bacteria. We have, however, observed that a structure called the crystalline style is absent from winter-harvested hard clams but may be detected when the clams are exposed to sufficiently warmed water. The crystalline style is a semitransparent, cone-shaped organ found in the vicinity of the stomach.

Several winter trials were conducted to determine the value of the crystalline style as a measure of hard clam activity during the depuration process. Results of these trials are detailed in Table 2. They indicate that, while all clams lacked a style initially, the structure was visible in 50% to 92% of the clams after exposure to the purification process.

Table 2 - Development of a Crystalline Style in winter harvested Hard Clams Subjected to the Depuration Process

Date Trial Initiated	Depuration Process Time in Hours	No. of Clams Examined	No. of Clams Possessing a Crystalline Style
1-7-69	0	24	0
	24	24	18
	48	24	22
1-14-69	0	24	0
	24	24	19
	48	24	16
1-21-69	0	24	0
	24	24	17
	48	24	19
1-23-69	0	24	0
	24	24	22
	48	24	16
3-18-69	0	100	0
	24	100	90
	48	100	92

[2] Red or Pink Colonies $\frac{1}{2}$mm. or more in diameter usually surrounded by a zone of precipitated bile salts.

Summary and Conclusions

The term "depuration", as related to shellfish and the shellfish industry, involves a process whereby shellfish harvested from certain restricted areas are placed in a controlled environment for a specified period of time in order to remove any bacterial or viral contamination that may be present. These shellfish may then be placed on the market for human consumption.

A program to evaluate the feasibility of depurating hard clams, utilizing a pilot-plant operation, has been completed by the State of New York. Hard clams were harvested by commercial methods from closed growing areas and subjected to a 48-hour process using sea water obtained from a well system. Shellfish samples were analyzed at 0, 24, and 48 hours to evaluate the effectiveness of the depuration process.

An analysis of the data gathered during this study indicated that the depuration process may use hard clam resources in restricted waters. The term "restricted waters" is defined in Part I, National Shellfish Sanitation Program Manual of Operations, as waters where the coliform median MPN does not exceed 700 per 100 ml.--and not more than 10% of the samples exceed an MPN of 2,300 per 100 ml. Furthermore, the area may not be so contaminated with radio-nuclide or industrial wastes that consumption of the shellfish located therein might be hazardous. As this definition implies, the depuration process is used only to remove bacterial and/or viral contamination. Contaminates such as heavy metals, pesticides, and radionuclides are not eliminated in the 48- or 72-hour process time.

The sea-water supply for the depuration process is of vital importance. The use of the salt-water well system in this program proved to be extremely effective; it is recommended that this source be considered and used, if available, at future depuration sites.

Data are presented for depuration trials conducted during the summer and winter seasons. The presence of the crystalline style does indicate hard-clam activity during the winter season, although the enumeration of a microbial indicator during this season would be more satisfactory in evaluating the process's effectiveness.

The program was terminated in 1969. An analysis of the data indicates that the depuration process may be used to cleanse hard clams taken from restricted waters. As a result, New York will authorize use of this process by private concerns. Specific growing area locations and plant designs will be considered and reviewed on an individual basis. New York will also provide laboratory support to ensure proper operation of the plant.

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DISEASE IN THE LIVES OF FISH
The Role of Pollution Is Now Being Assessed

Richard Wolke

Ichthyopathology, or the study of fish diseases, is a discipline that bears out the prophetic words of Rudolf Virchow, who said in the late 1800's, "Between animal and human medicine there is no dividing line. . ." Although still in its infancy, the discipline is rapidly awakening the interest of such diverse investigators as the comparative pathologist, the cancer researcher and the ecologist. This interest was reflected in the establishment last year of a small diagnostic and research histopathology laboratory at the University of Rhode Island where fish tissues are examined microscopically for evidence of disease.

The sudden popularity of the field can certainly be attributed in part to the world's rapid increase in population, which has called upon all scientists to find new means of resource conservation and to feed this growing mass of humanity. But the primary stimulus for its new popularity can be attributed to two groups until recently rather widely separated in their interests--the aquaculturists and the comparative pathologists.

Aquaculturists Concerned

Aquaculture has been an important and integral part of agriculture for many centuries, especially in such countries as China and Japan, where fish make up a good proportion of the daily diet. As in any intensive livestock operation, be it with birds or mammals, the bringing together of large numbers of animals in a confined area lends itself to the rapid spread of disease processes. Aquaculture is not immune to this phenomenon. So it was the aquaculturist who first began to ask pertinent questions about fish mortality, and it was the aquaculturist who first began the study of fish diseases.

As the field of human medicine became more sophisticated, it became apparent that diseases of lower vertebrates, long studied by veterinarians, could add much to the body of knowledge collected by the physician. The words of Virchow, who is considered the father of modern pathology, were indeed prophetic. The veterinary pathologist was in a position to supply the physician with animal models of human diseases. It was only a question of time before these veterinarians began to see the importance of fish diseases and to study these diseases in an attempt to help both the physician and the aquaculturist.

Do Fish Suffer Disease?

For the uninitiated, the field of ichthyopathology may raise a number of questions. For instance, do any fish diseases of consequence in fact exist? Are diseases responsible for some of the mass mortalities--fish kills--we occasionally read about in our newspapers? Do they have an effect upon population dynamics or fluctuations of fish in the wild? Are they involved in mortalities connected with aquaculture projects? The answer to all of the questions is yes. Disease plays an important role in the life of all species of fish.

In fact, our investigations indicate that fish suffer from much the same kinds of diseases as man and the other higher vertebrates. Fish contract viral, bacterial and fungal diseases. They, like man, are neither immune to diabetes nor leukemia. Some of their diseases reach epidemic proportions and are responsible for mass mortalities of natural populations. One of the most important killers of fresh-water fish is the bacteria Aeromonas liquifaciens, an ubiquitous organism which, under the right environmental conditions, may increase rapidly in numbers and virulence. Marine fish, too, are no exception to epidemic disease processes. A case in point is the 1933 mass mortality of herring in New Brunswick due to the fungus Icthyophonus hoferii.

At present we are unable to state positively what proportion of fish kills are due solely to disease. We are unable to do so because so few kills are examined by competent pathologists. Qualified investigators are not often called to the scene of the kill and, if

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objective investigations are made, they are usually concerned only with water quality. If the water meets approved standards, the cause of mortality usually goes undetermined.

Pollution Kills Many Fish

There can be little question that present day pollution of our streams and rivers is responsible for many mass kills of freshwater fish. Pollutants that affect acidity, alkalinity or dissolved oxygen, or which increase the heavy metal content of the water may be responsible for sudden kills of massive numbers of fish and other aquatic fauna.

Dr. Wolke examining a lesion, or abnormal change within tissue, in a filet of an ocean pout. About 25 years ago these lesions caused the disappearance of ocean pout from the fresh fish market for esthetic reasons. There is no reason to believe the disease is communicable to man.

Of interest to the pathologist, however, is the relationship between low levels of pollution and disease processes. There is much evidence in the literature that this relationship is synergistic, meaning that the combined effect of these factors may be more devastating than any of them acting alone. For instance, the added stress of lowered oxygen tension may increase the risk of fish contracting various infectious bacterial diseases. Other controlled experiments have shown a higher incidence of disease in fish exposed to low levels of insecticides.

Poor Year-Class

In some instances, heavy infestations with intermediate (developing) stages of tapeworm parasites, while not responsible for mass mortality, may be responsible for sterility, leading to poor year class production and definite effects on population dynamics. The best example of this disease type is the freshwater bass tapeworm, Proteocephalus ambloplitus. The bass normally harbors the adult worm in its intestines with no ill effects. However, in areas of dense tapeworm populations, the bass may serve as its own intermediate host and be infected by the larval or plerocercoid stage of the worm. Under these circumstances, the plerocercoid may take up residence in the ovary, resulting in destruction to potential and actual ova.

Diseases of Wild Populations

If the diseases of wild populations of fish were surveyed by randomly sampling them throughout the year, a broad spectrum of diseases would be found, caused by a number of agents. Most commonly, the lesions observed may be classified histopathologically, but will be of unknown origin. This is a reflection on the serious lack of knowledge in the field of ichthyopathology and can be overcome only by patient observations and descriptions. The comparative pathologist must collect base data in order to become aware of the many diseases that certainly exist in the fish, but are presently unknown.

In such a survey, the majority of known lesions will probably be due to the larval stages of migrating worms of the helminth parasite group. This is not to say that parasites are responsible for killing large numbers of fish, for it is indeed a poor parasite that kills its host. There can be little question, however, that such larval migrations are

responsible for decreasing the efficiency of organs infected. In those isolated instances where overwhelming infections do occur, they are responsible for fatalities.

Probably the second most important causative agent recorded would be protozoa (one-celled animals). Fish suffer from a wide number of protozoa, which are both internal and external parasites. This is not surprising, because their aquatic environment is ideal for the reproduction and passage of such organisms. The survey would also include bacterial and fungal diseases, instances of disturbed metabolism, congenital anomalies and, on rare occasions, tumorous processes. It is an unfortunate fact that such a survey would miss many of the older, diseased and weakened fish because of the nature of this environment, where predators and scavengers are quick to dispatch the slow and unhealthy specimens.

Fish Diseases in Aquaculture

It is, however, under aquaculture conditions that we see the most striking examples of fish diseases. In warm, fresh water culture, protozoan external parasites such as Ichthyophthrius multifilis, Chilodenella sp. and Trichodina sp. are responsible for large losses of fish. Bacteria, especially Aeromonas sp. are also serious pathogens. In cold, fresh water husbandry of salmon and trout, a number of viral diseases have been described such as infectious pancreatic necrosis, Egvedt disease and infectious hematopoietic necrosis. Bacterial agents responsible for heavy mortalities have also been incriminated in salmon and trout production. These include the causative agents of furunculosis, Aeromonas salmoncida and Cytophaga psycrophilia, the probable cause of 'cold water disease.' In addition, aquaculture projects are not free of nutritional imbalances or of toxins introduced with the feed, such as aflatoxin, which proved responsible for hepatomas in trout.

Methods for the farming of marine fish (maraculture) are now being seriously explored. Here, too, agents responsible for disease are being regularly recovered. They are the same kinds of etiologic agents we face in fresh water environments, but are adapted to higher salinities.

It is not enough, however, for the aquaculturist simply to know what kind of disease his fish have contracted. If he is to be a successful producer, he must be able to prevent and cure these diseases. Much research is presently being done in the field of therapeusis. We know that many fish pathogens are susceptible to antibiotics commonly used in human and veterinary medicine. Nonetheless, problems arise in dosage rates, means of efficient administration and in treatment of viral and parasitic diseases that are resistant to antibiotics.

Immunizing Agents

One of the most exciting areas of therapeusis is production of biologicals or immunizing agents. It has been known for some time that higher fish are capable of producing antibodies. But only recently has it been shown that these antibodies are able to protect fish against diseases. One major problem is the temperature-dependent nature of the antibody-producing mechanisms of the fish. That is to say, below 50 degrees Fahrenheit antibody production essentially ceases, so that diseases contracted at low temperatures may be resistant to active immunization. The ideal situation would be the development of an oral immunizing agent that could simply be added to tank or pond water to produce a solid and long lasting immune response.

Fortunately the fish, like higher vertebrates, has natural protective mechanisms against many of its diseases. Inflammation is, in fact, the body's response to invading organisms. The inflammatory response of fish is quite similar to the inflammatory response of man and other mammals. The fish is capable of "walling off" a TB nodule or producing cells capable of ingesting and destroying invading bacteria, so that in the wild the disease is not always successful. It is these very inflammatory responses so important to the health of the fish that are also of such vital interest to the comparative pathologist in his study of human and animal diseases.

Fish Diseases Spread to Humans?

An area as yet unstudied is the relation of fish diseases to human health. A disease transmissible from animal to man is known as a zoonose. We are aware of a few zoonoses of fish origin such as the broad tapeworm of man Dibothociphalus, and the bacteria Erysipelas sp. Work in 1968 by investigators

studying fish in Chesapeake Bay indicated that fish close to densely populated areas of human habitation had antibodies against a number of human pathogens. The exact significance of this work has not been determined, but it is indicative that fish may serve as monitors of human disease organisms and therefore may be of public health significance. Recent work by this author (1970) indicates that striped bass, white perch and mummichogs carry a psittacoid agent, which is a microscopic organism similar in some respects to both virus and bacteria. It is similar in appearance to the agent responsible for parrot fever in man. However, interest in the public health aspects of fish diseases has been limited and they must be more intensively investigated.

Diagnostic & Research Lab

The diagnostic and research histopathology laboratory for the study of fish diseases was set up at the University of Rhode Island through the cooperation of the College of Resource Development and the Graduate School of Oceanography, with financial assistance from the Sea Grant program of the National Oceanic and Atmospheric Administration. This laboratory offers diagnostic services to aquaculturists throughout New England. Diseases under investigation include, 'cold water disease' of salmon, Plistophora infections of ocean pout and psittacoid infections of marine fish. By means of a continuing survey of marine fish, both normal and abnormal tissue sections are being collected, classified and stored to serve as base data for teaching and future research projects. The laboratory is also working in conjunction with the International Congress Against Cancer in an attempt to recover and classify neoplastic processes of bottom feeding fish.

TAIWAN'S USE OF FISHERY RESOURCES

Yung C. Shang

The fishing industry is among Taiwan's most vital assets. Exploitation of fishery resources has grown rapidly during the past decade. The annual average production growth rate is about 11.6%. This article examines the industry's place in Taiwan's economy, development trends, and the major factors that may account for the industry's rapid growth.

Fisheries in Taiwan's Economy

Fish production affects income, foreign markets, employment, and food intake.

In 1969, fishery landings increased to a record 560,918 metric tons worth about $146 million--about 3.07% of the Gross National Product. Between 1960 and 1969, catch and value more than doubled.

In 1969, fish exports were more than 146 times those of 1960. They totaled 101,284 metric tons valued at $44.7 million and produced a favorable balance of trade of marine products of about $38 million. The larger the export surplus, the more foreign exchange is available to purchase capital goods necessary for fishery development. Moreover, the expansion of fish markets, both internal and external, is a powerful income generator that stimulates the growth of supplementary industries. In 1969, some of those to benefit were: 60 ship building and repair yards, 417 fish-processing plants, 341 ice-making plants, and 275 cold-storage and freezing plants.

Fishing operations provide many jobs. In 1969, nearly 286,404 people were fully or partly employed, about 6% of all workers. Moreover, the fisheries are an alternative livelihood for the farm population living in and around coastal villages.

The increase in fish production also assures Taiwanese of an adequate supply of an important source of nutrition. The Food Balance Sheet of 1962-1968 shows that fish consumption accounts for about 55% of animal protein intake.

Development Trends

There are four classifications of fisheries in Taiwan: deep-sea, inshore, coastal, and culture. These classifications differ primarily in the relative distance from shore of the fishing areas, and in craft and gear used. Deep-sea fisheries use powered vessels of 50 or more tons and operate as far out as the Southwest Pacific, the Indian, and Atlantic Oceans. Inshore operations use primarily medium and small powered craft usually within 30 nautical miles of shore. Sampans and bamboo rafts--the working fleet of coastal fisheries--operate along shores and on rivers and lakes. Fish culture concentrates on the resources to be found in brackish and freshwater ponds, shallow water, and paddy fields.

Decade of Progress

Between 1960 and 1969, the total catch more than doubled (Table 1). Intensified exploitation of deep-sea and inshore fisheries accounted for the large increase. Deep-sea and inshore fishery production increased 199% and 134%, respectively, between 1960 and 1969; production of these two fisheries was about 85% of the total 1969 production compared with 70% in 1969. The relative importance of coastal fisheries is declining because of the limited fish resources in inner coastal areas and increased competition from the rapid expansion of deep-sea and inshore fisheries.

Table 2 indicates that the number of fishermen declined between 1960 and 1969 primarily because of the mechanization of fishing operations. However, the number of full-time fishermen shows no significant change. This implies that the number of part-time fishermen decreased. The expanding powered fleet has permitted the transfer of many part-time fishermen to full-time status.

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TABLE 1

ANNUAL FISHERIES PRODUCTION,[a] 1960-1969
(in thousand metric tons)

Year	Total	Deep-sea Fisheries	Inshore Fisheries	Coastal Fisheries	Fish Culture
1960	259 (100)	85 (100)	95 (100)	30 (100)	49 (100)
1961	312 (121)	106 (125)	117 (123)	32 (105)	57 (117)
1962	327 (126)	114 (133)	132 (140)	32 (107)	49 (99)
1963	351 (135)	120 (141)	144 (152)	37 (123)	50 (102)
1964	376 (145)	127 (149)	161 (170)	32 (107)	56 (115)
1965	382 (147)	136 (160)	161 (170)	31 (102)	54 (110)
1966	425 (164)	169 (199)	172 (182)	25 (84)	59 (119)
1967	458 (177)	189 (222)	187 (197)	26 (88)	56 (115)
1968	531 (205)	241 (283)	208 (219)	25 (83)	57 (115)
1969	561 (217)	255 (299)	222 (234)	27 (90)	57 (116)

[a]Numbers in parentheses are indexes, 1960 = 100.

Source: Taiwan Fisheries, published by Taiwan Fisheries Bureau, 1969.

TABLE 2

INDEX OF FISHERMEN AND VESSELS, 1960-1969
(1960 = 100)

	Fishermen		Vessels			
				Powered		
	Total	Full-Time	Total Number	Number	Tonnage	Horse Power
1960	100	100	100	100	100	100
1961	97	102	98	105	107	111
1962	96	102	94	109	111	117
1963	95	103	95	117	117	126
1964	94	99	89	138	130	147
1965	88	85	88	147	150	173
1966	86	90	89	160	181	213
1967	87	94	91	174	224	283
1968	89	101	90	182	261	302
1969	90	101	97	189	294	337

Source: Derived from Fisheries Yearbook, Taiwan Area, 1969, published by Taiwan Fisheries Bureau, 1970.

Since production more than doubled between 1960 and 1969, while number of fishermen declined 10%, productivity per man increased significantly. Similarly, a decrease in total number of fishing vessels and a large increase in number of powered boats indicate the substitution of powered for nonpowered craft; also they suggest an increasing capital-labor ratio as the chief reason for increased productivity.

Examining the composition of Taiwan's fishing fleet during these years, Table 3 verifies that the change in new technology was more capital-using than capital-saving. That is, all tonnage classes of powered vessels showed increases in number except the 50-99.9 class; the largest increase was in over-100-ton class.

A sharp rise in the number of vessels over 100 tons can be explained by the high profitability of investment in large ships. This conclusion is verified by the results in Table 4 based on a sample survey in 1965 of production costs of private fishing.

There is no significant change in the average product per boat-ton for the class over 100 tons. The production cost per boat-ton, however, is much lower for boats in the large classes. In addition, the large vessels typically exploit fish of high value, which usually are exported at high prices and generate greater net profit.

Moreover, ships in fishing operations not only increased in size between 1960 and 1969, but also in power per gross tonnage (Table 2). The number of powered vessels increased 89%; gross tonnage increased 194%; and horsepower increased 237%. A more powerful engine increases the potential number of fishing trips at the margin, thereby increasing potential profit.

TABLE 3

INDEX OF POWERED FISHING VESSELS BY GROSS TONNAGE, 1960-1969

	Less than 5 tons	5-19.9 tons	20-49.9 tons	50-99.9 tons	Over 100 tons
1960	100	100	100	100	100
1961	101	110	106	99	125
1962	105	117	110	93	140
1963	111	128	100	93	153
1964	127	164	104	110	162
1965	131	186	110	84	223
1966	138	198	117	85	351
1967	144	226	133	88	477
1968	147	233	155	80	575
1969	150	228	232	78	662

Source: Derived from Fisheries Yearbook, Taiwan Area, 1969, published by Taiwan Fisheries Bureau, 1970.

TABLE 4

AVERAGE PRODUCTION AND COSTS PER BOAT TON BY VESSEL SIZE

Size Class (tons)	Average Production Per Boat Ton (M.T.)	Average Production Cost Per Boat Ton (N.T. $)[a]
50 - 100	2.5	26,000
100 - 200	3.7	23,000
200 - 500	3.5	20,000
500 - 1000	3.4	20,000

[a] New Taiwan dollars. $1 = N.T. $40.10.

Source: Report on the Sampling Survey of Production Costs of Private Fisheries in Taiwan, 1965, published by Taiwan Fisheries Bureau, 1966.

Factors Favorable for Rapid Growth

The trends of industry development have resulted in the modernization of equipment and technique. Emphasis was placed on substitution of capital for labor. This is a costly process. It cannot be accomplished on a large scale with rapid growth unless the basic resource, fish stock, is plentiful enough to justify large investment; the government is willing and able to provide technical and financial aid and to assist in research and training; the institutional structure is favorable for development; and markets, domestic and foreign, show promise for expansion.

Abundant Natural Resources: Taiwan's 1,600-Km.-long coastline and its favorable marine environment leave little doubt as to the abundance of fish resources. Deep water abutting precipitous cliffs along the Eastern Coast forms a favorite highway for migratory fish from both South and North; and a gradually inclining western shelf, abounding in biological nutrients, provides an excellent habitat for fish propagation. This convenient access to fish resources, limited arable land, and a rapidly growing population largely account for the increasing attention toward exploitation of marine resources as an important part of Taiwan's economic reconstruction.

Government Assistance: Rapid fishery growth also has benefited from an active and vital role played by the government.

The significant addition since 1960 of powered fishing boats, for example, is a direct result of a governmental plan: "Concentrative Utilization of Capital for the Exploitation of Marine Resources." By 1968, more than 100 new ocean-going fishing vessels, 150-1,500 tons, were built with government funds. According to a 5-year program launched in 1968, the projected fish catch in 1972 is 800,000 metric tons; to achieve it, $29 million will be invested in 131 new fishing boats. The loans are obtained primarily by, or through, the government from the World Bank, Asian Development Bank, American Aid funds, or authorized bank loans.

Government funding also has been important in financing technological innovations in fishing technique and equipment. During the 1940s, most fishing boats used semidiesel, electric-ignition engines; at present, nearly 80% of all powered boats are equipped with diesel engines. The substitution of electric generators for conventional batteries and the use of synthetic fiber net also have enhanced fishing efficiency. Most deep-sea fishing craft contain the most up-to-date navigation

and electrical equipment, including fish finders, direction finders, radio transmitters and receivers, line haulers, cold-storage and freezing facilities, and radar and loran.

Government services used by the fishing industry are an equally important factor in the rapid fishery growth. For example, the fishing harbor at Kao-Shiung in Southwest Taiwan has been expanded and its facilities improved by the government to accommodate 600 vessels in the 100-ton class. Radio stations have been established with government assistance to disseminate oceanographic, meteorological, biological, and marketing information. To further the development of deep-sea fishing, the government has established 50 foreign bases in the South Pacific, the Indian and Atlantic Oceans, and in the Mediterranean Sea. Fishermen using these facilities can unload and resupply locally and thereby reduce operational costs.

Government impact on fishing-industry success is noted too in recent attempts to coordinate fishing development programs with education, training, and research. At present, 3 colleges, 5 fishery vocational schools, and 3 fishery research institutes exist in Taiwan to further marine studies. The colleges emphasize navigation, marine engineering, fish processing, shipbuilding, fishing technology, and fish management. Research and experimentation in fishing techniques, fishing biology, fish preservation, exploration of fishing grounds, and collection of fishing data are carried on at fishery research institutes.

Also, the Taiwan Fisheries Bureau has conducted short-term training classes to impart fundamental knowledge and skills to potential fishermen, and to those transferring from inshore to deep-sea fishing. These courses include instruction for deep-sea long-liner skippers, deep-sea mechanical technicians, deep-sea fisheries' radio operation of new navigation and fishery apparatus. These classes have improved the productivity of the labor force and increased the supply of skilled workers for mechanized high-sea fishing.

Fishermen's Associations: The extent to which fishermen have organized to enhance their own welfare has contributed much to the success of the fishing industry.

As in agriculture, there is often a feeling that the producers of raw materials are not adequately rewarded for their labor, while wholesalers and retailers receive more than their share of profit. The fishermen's desire to increase their bargaining power has been a major factor in the formation of 68 fishermen's associations at the district/city level, and one at provincial level. These associations have influence, as can be seen in the "Regulation Governing the Wholesale Market of Agricultural Commodities in Taiwan Province." According to this law, all first-hand sales of fish must be made through a wholesale fish market near where the fish are caught; an exception is remote fishing villages, where the catch generally is sold at landing site.

Wholesale marketing is one primary function of fishermen's associations, which operate the market and provide the site and facilities. The market transaction generally is by auction, and only licensed dealers can bid. If the owner is not satisfied with the bid price, he retains the right to reject it and place his fish into cold-storage provided by the association. After the transaction, the association deducts 2.5% of sales value to cover operation, improvement of marketing facilities, and fishermen's welfare activities.

The associations are required to collect another 2.7% of sales value to cover stamp tax, business taxes, the fishermen's share of a harbor maintenance fee, and collective fishermen's insurance in contract with the Labor Insurance Bureau of the Taiwan Government. Covered by the fishermen's insurance are child birth, sickness, death, old age and disability.

The associations serve other functions. They assist fishermen in purchasing fuel and oil from government-operated Taiwan Petroleum Company; they assist fishermen in negotiations with manufacturers for the purchase of engines, fishing gear, and navigational equipment; they negotiate loans from the government and banking institutions, and re-extend at their own risk to members who cannot provide sufficient collateral to meet the requirements of banks. Bait fish is bought and sold within the association by member fishermen. In foreign purchasing, applications for import permits and foreign exchange usually are made through the associations.

The associations also are extension services through which the government can help the fishermen increase efficiency. Study groups may be set up to exchange information on fishing grounds, fishing gear, and techniques. Fishing contests, navigation safety facilities, net-treating facilities, cold-storage facilities, harbor improvements, etc., are other services contributing toward improving fishing efficiency and boosting fishery production.

Expanding Markets: Expanding foreign markets and high export profitability reflect Taiwan's growing fishing industry.

Traditionally, Japan has been the world's leading country in fish export. The competitive position of Japanese fish exports is based mainly on cost factors. Production costs (largely labor cost) of the Japanese tuna fleet have risen sharply in recent years with general rise in Japan's economy. Japan faces increasing competition from Taiwan and South Korea. The latter's lower labor costs have strengthened their competitive positions in world markets. Also, domestic consumption of tuna in Japan is rising as income rises. A larger proportion of its catches is consumed at home. Therefore, Japan, has lost part of its world market, especially U.S., to South Korea and Taiwan. Due to increased world demand for fish, the world prices of frozen tuna and shrimp have become much higher than domestic prices in Taiwan. The high profitability of tuna and shrimp export to the expanding world market contributes much to the rapid expansion of Taiwan fisheries.

A Look Ahead

Whether or not Taiwan's fisheries continue to grow rapidly in the future will depend upon their ability to adapt to changing conditions. Biological studies indicate that the potential increase in the world tuna production, excepting skipjack, is very limited. Also, fleet labor costs have risen significantly in recent years due to the rapid growth of the industrial sectors. These suggest: (1) Taiwanese fishermen, if they are to increase their share of a limited supply must rely upon superior technique and efficiency to reduce production and marketing costs; (2) Since the potential yield of albacore, yellowfin, and bluefin is limited, deep-sea fisheries development should be diversified; and (3) Attention should be directed toward exploitation of skipjack resource, which remains underexploited.

Whatever direction the industry takes, it will always have to operate under the constraint of being part of a worldwide fishing community. After all, commercial fishing is carried on primarily in international waters where producers from all countries compete for a limited, fugitive resource. The fish belongs to no one until captured. Exploitation in any region may exceed maximum sustainable level of catch. The effect is to raise the aggregate costs of fishing. This dissipates the potential economic rent through a larger effort than is necessary to catch the allowable maximum yield; it results in a loss to everyone's economic welfare. Therefore, it is desirable to encourage international cooperation and coordination of research efforts--as well as international regulatory measures to limit catch in a region to a level that would maximize the potential economic yield.

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HOW TO INSTAL AN ECHO SOUNDER IN A SMALL FIBERGLASS BOAT

Larry D. Lusz

The standard technique for installing an echo sounder on a vessel is to mount the transmitting/receiving transducer on the exterior of the hull. For large displacement vessels, this method of installation does not create many problems because the boats operate in deep water at relatively slow speed. However, the externally mounted transducer generates several problems on smaller boats. The most significant problems are the tranducer's vulnerability to damage when operating in shallow water or placing the boat on a trailer, and reduced performance of the boat hull.

In small boats, a more practical place to mount the transducer is inside the hull. Many smaller boats are constructed of reinforced fiberglass plastic; therefore it may be possible to transmit and receive acoustic signals through the hull's bottom. An internal transducer mounting would offer several advantages over external mounting by solving the abovementioned problems--and allowing easy access to the transducer for maintenance and repair. However, boat hulls with air bubbles or filler materials in the fiberglass could present a problem by reducing the echo sounder's performance.

This paper reports the results of the installation of an echo sounder in a fiberglass boat. The transducer was mounted inside the hull in a watertight well.

THE BOAT AND ECHO SOUNDER

The boat, a Thunderbird[1/] (model Iroquois), is 23 feet 9 inches long at the center line, and 8 feet wide across the beam. It has a cathedral-style hull with a small enclosed cabin forward. It is powered by an inboard/outboard drive unit with a 200-horsepower engine.

The boat is constructed from reinforced fiberglass plastic with wood structural members. The manufacturer says the hull was constructed from a combination of polyester-type resin and glass fiber that was relatively free of air bubbles and filler materials.

The echo sounder was a Ross Fineline Model No. 200 operating at a frequency of 105 kHz. Maximum range of the system was 200 fathoms. Power at 12 v.d.c. was supplied to the transmitter/receiver from the boat batteries. The readout was of the dry-paper type.

The piezoelectric transducer was constructed from barium titanate. It had a diameter of 5 inches and a length of 3 inches. The beam angle was 8 degrees.

ECHO SOUNDER INSTALLATION

A watertight well was designed for mounting the transducer inside the boat (Figure 1). Initially, the well was filled with sea water to conduct tests of sound level measurements; but oil or other viscous incompressible fluids,

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1/Trade names referred to in this publication do not imply endorsement of commercial products.

COMMERCIAL FISHERIES REVIEW
Reprint No. 909

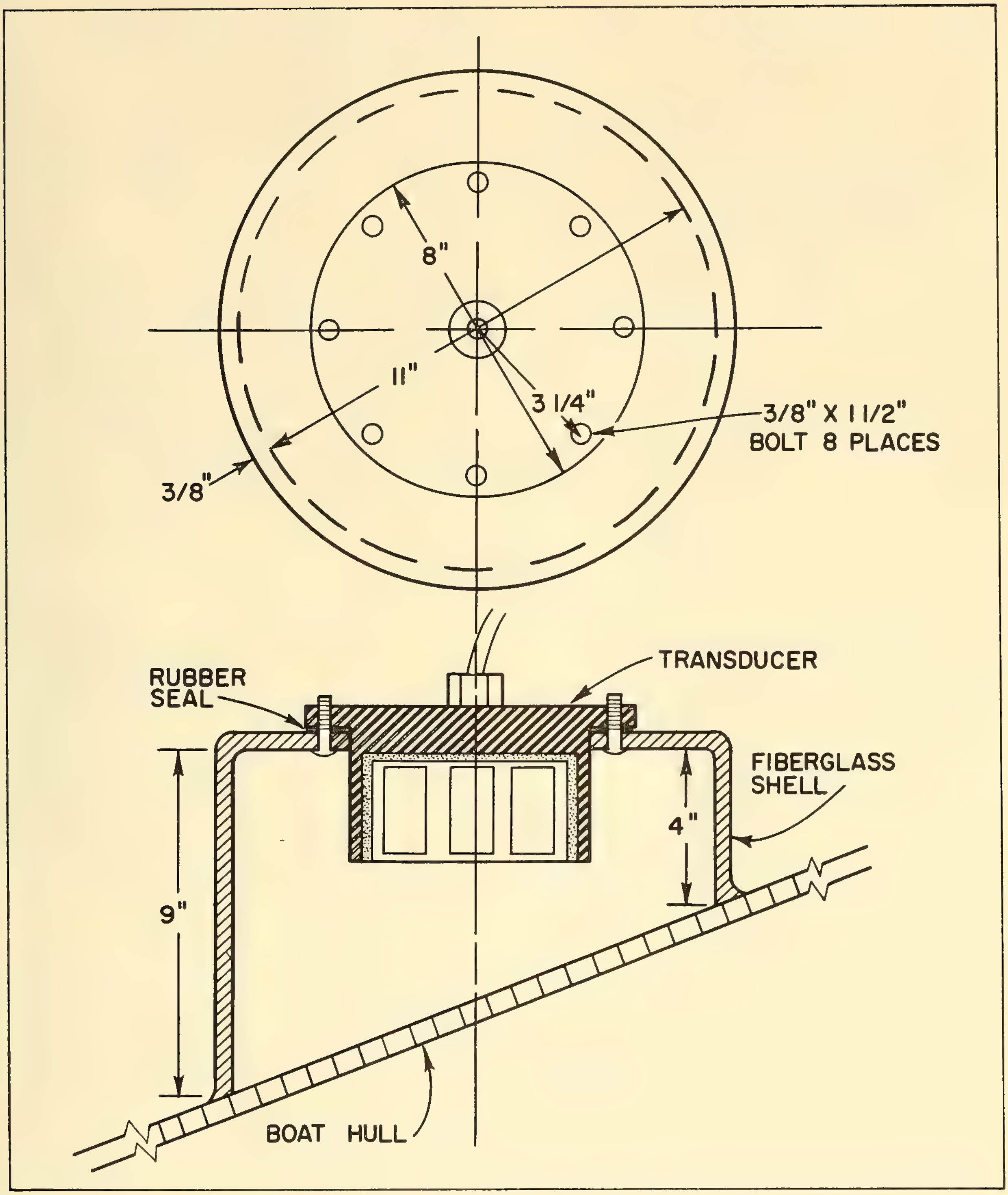

Fig. 1 - Well design for installing transducer inside boat hull.

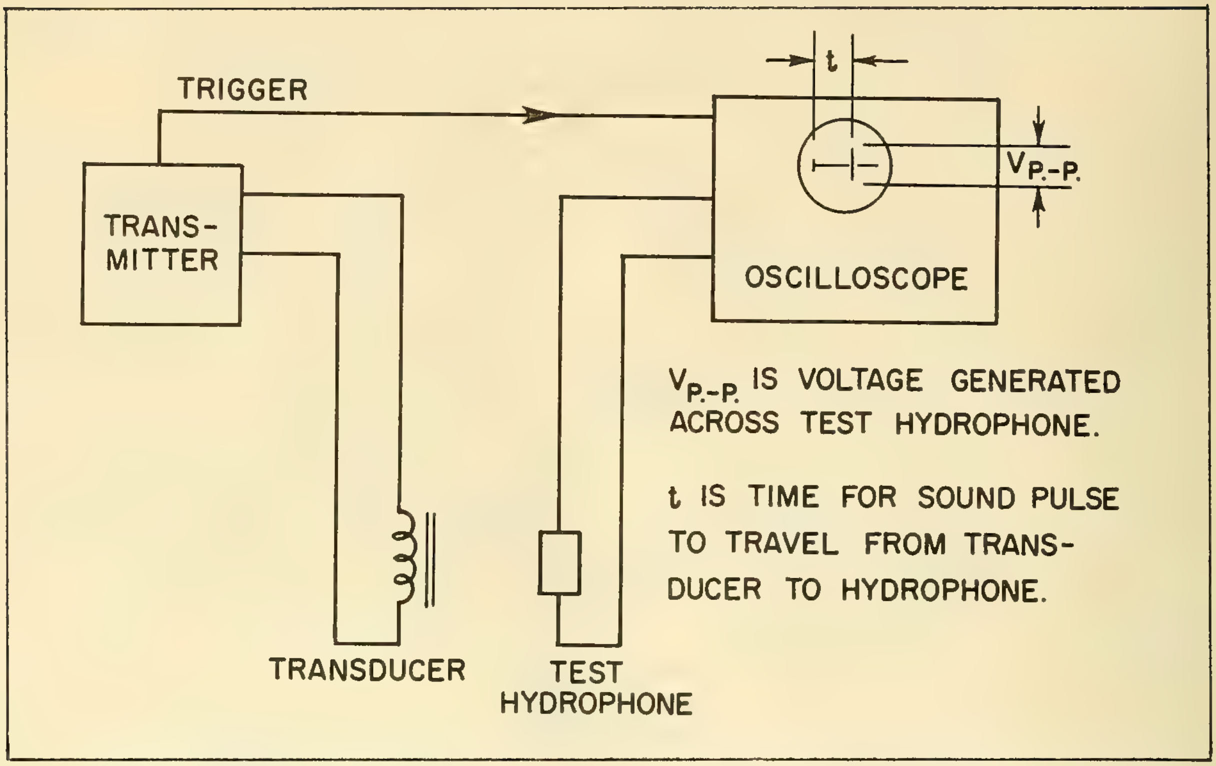

Fig. 2 - Block diagram for determination of separation distance between transducer and hydrophone and for source level measurement.

with sound transmission characteristics similar to sea water, could be used to couple the acoustic energy into the water.

The readout and transmitter/receiver were mounted on the port bulkhead in the cabin of the boat. These units could be installed in weatherproof boxes for external mounting on cabinless boats.

TESTS TO DETERMINE TRANSDUCER EFFICIENCY

Tests were conducted to determine the relative efficiency of an internally mounted versus an externally mounted transducer. The source level at a distance of 1 yard can be calculated from the following equation: $S = 20 \log V_{hydro} - M + 20 \log R$ where S is the source level in db/u bar, V_{hydro} is the rms voltage across the calibrated hydrophone, M is the open circuit receiving sensitivity at one yard for the calibrated hydrophone,[2/] and R is the distance in yards between the transducer and calibrated hydrophone[3/].

The source level was measured with the circuit shown in Figure 2 with the transducer installed in the boat. The measurements were performed in water that was 30 feet deep with the boat tied to a dock. A calibrated test hydrophone was lowered into the water beneath the echo-sounder transducer. The hydrophone was adjusted until its acoustical axis

2/M = -112.8 db/u bar (calibrated by Applied Physics Laboratory, University of Washington).
3/Kinsler, Lawrence E., and Austin R. Frey, "Fundamentals of Acoustics," John Wiley & Sons, Inc., New York, 1962.

was aligned with the acoustical axis of the transducer as determined by maximum signal deflection on an oscilloscope. The peak-to-peak voltage generated across the test hydrophone and the exact distance between the hydrophone and transducer were then measured with the oscilloscope.

The source level measurement was repeated with the transducer located on the exterior of the hull. By comparing the two measurements, the effect of transmitting through the hull and, subsequently, the relative efficiency of each transducer configuration could be determined.

RESULTS AND CONCLUSION

The results of the source level measurements are tabulated in table. The similarity in source level measurements when the transducer is mounted either inside or outside the boat show that the transducer can be mounted inside the boat hull without a reduction in sensitivity. The advantages of an internal mounting are significant. Maintenance time and repair costs are less due to ease of access to the transducer. Also, the vulnerability of the transducer to damage is reduced.

Source level measurements of transducer configurations

Location of transducer	V_{hydro} (V peak-to-peak)	R (yds)	S (db/u bar @ 1 yd)
Transducer mounted inside boat	.06	8.2	95.9
Transducer mounted outside boat	.07	7.9	95.6

THE SEPARATION OF CRAB MEAT FROM SHELL & TENDON BY A CENTRIFUGAL PROCESS

Wayne I. Tretsven

In a laboratory study of improved methods for removing shell fragments and tendon from hand-picked Dungeness crab meat, researchers at the Seattle Fishery Products Technology Laboratory examined the application of centrifugal force to the problem. Trials with an industrial, solid-bowl centrifuge indicated that a machine of this type had great potential for the separation of meat from shell.

The centrifuge, a Bird Machine Co.* solid-bowl machine, designed primarily for the classification and separation of materials like gravel, had a rated capacity of 0.7 cubic foot of solids per minute and required a 30 hp motor to overcome the starting inertia. The unit required 15 hp for normal operation after starting.

In these studies, the machine (Figure) was fed with chopped crab or crab shell in a saturated brine slurry. The separated meat was screened from the brine as it left the centrifuge. The brine was recirculated at rates up to 15 gallons per minute.

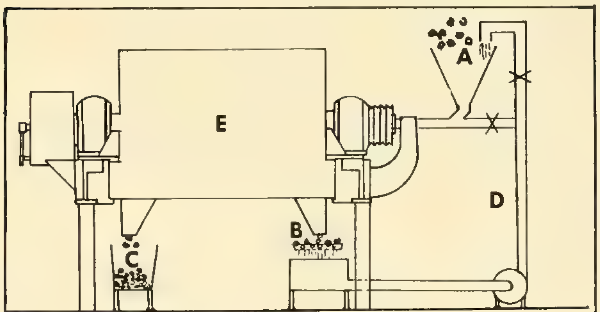

Diagram of centrifugal process for separation of crab meat from shell.

Separation of Picked Meat from Shell & Tendon

The centrifuge was first tried with fresh, commercially picked Dungeness crab meat obtained from the "shaking" table. This meat contained pieces of shell and tendon that are removed by brine flotation in normal plant practice. The material was slowly added to the hopper from which it was carried by saturated brine at approximately 12 gpm into the bowl that rotated at 2,000 rpm. Within 2 or 3 seconds, pieces of meat appeared in the effluent. Pieces of shell and tendon were thrown from the solids discharge end of the centrifuge. Little or no meat was carried over with the shell or tendon and, aside from the pieces of tendon that were attached to meat, no shell or tendon remained in the meat. If pieces of gill were mixed with the meat, they remained with the meat during centrifugation. Usually, pieces of gill are removed at the time of butchering. Although the recovered meat was shredded and excessively salty to taste, the first trials showed that it is feasible to separate crab meat from crab shell by means of a centrifuge.

Recovery of Meat from Crab Shell Scrap

Dungeness crab shell scrap (the shell remaining after the removal of meat by hand) was chopped into pieces ranging in size from about $\frac{1}{8}$ to $\frac{1}{2}$ inch and fed into the hopper in saturated brine. The centrifuge separated the slurry into meat-free shell and shell-free meat. In three different lots of scrap used, the meat recovered ranged from 14 to 20 percent of the weight of the scrap. This is roughly equal to 15 percent of the weight of the meat removed by hand picking.

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COMMERCIAL FISHERIES REVIEW
Reprint No. 910

The meat from the shell scrap was of small particle size, perhaps in part because of chopping. However, it was darker in color and flakier than the pieces of muscle described in the previous section. This meat could be valuable alone, but it appeared to us that its greatest value was as an ingredient for blending with larger, more fibrous pieces of meat for use in manufactured products such as crab cakes.

An example of recovery of meat from scrap in a "typical" Dungeness crab plant might be useful in pointing out the potential significance of this procedure. If we assume a plant with 20 pickers or shakers, each of whom produces 100 pounds of meat an hour for six hours per day, the total shell scrap produced per day is approximately 12,000 pounds. Using a realistic figure of 15 percent yield of meat from the scrap, it is clear that about 1,800 pounds of meat are recoverable. Assuming further that the quality of the recovered meat is such as to yield a return only half that of easily shaken meat, using May 1971 prices for Dungeness crab meat, the 12,000 pounds of scrap shell produced daily contains recoverable meat worth about $1,400.

Centrifugal Recovery of Edible Meat from Other Crab Species

In separate experiments, Dungeness crab body and leg sections, blue crab claws, and snow crab legs and bodies were chopped and then fed into the centrifuge in a saturated salt solution slurry. In all cases, the meat was free from shell and tendon, and the shell was free from meat. As was the case in other tests, the meat was shredded and more salty than desirable. Yield data were not obtained for Dungeness crab. Yields from blue crab claws and snow crab legs and snow crab body sections are shown in table.

Yield of meat obtained by centrifugal treatment of blue crab claws and snow crab body sections and legs

Source of meat	Yield of meat
	Percent by weight
Blue crab claws (cooked)	31
Snow crab bodies (cooked)	52
Snow crab legs (cooked)	29

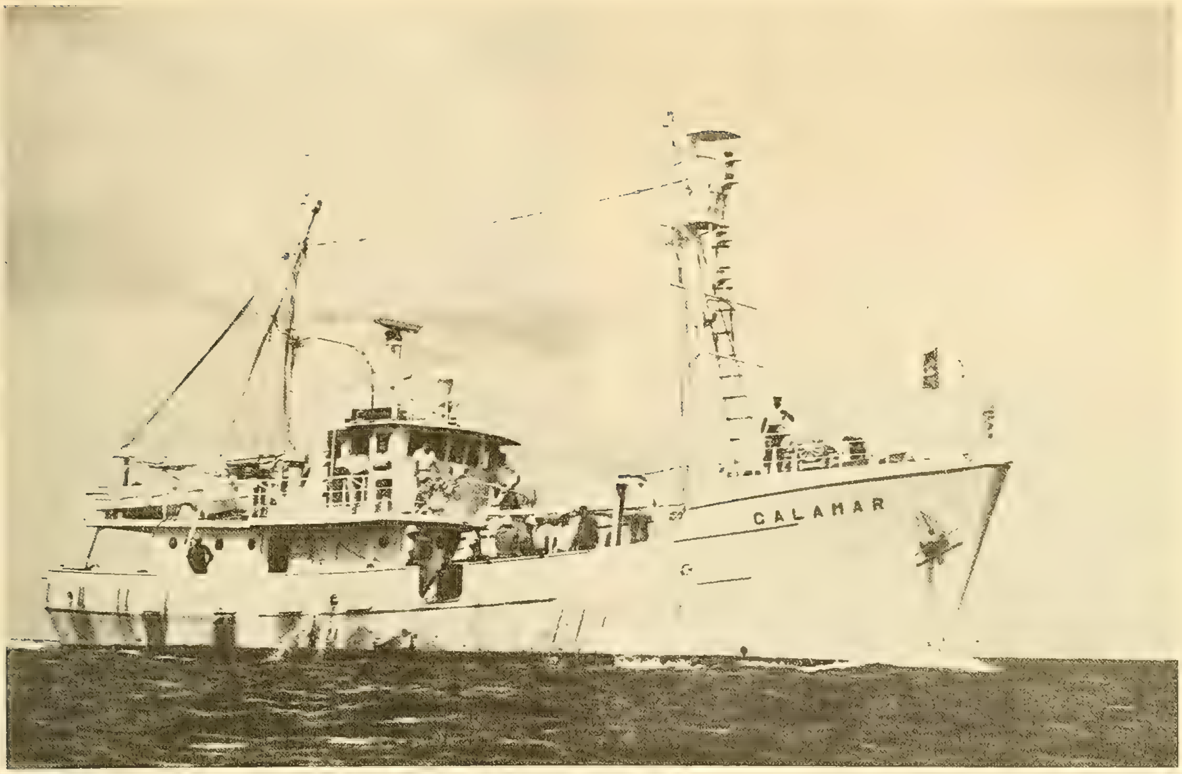
Recent Developments

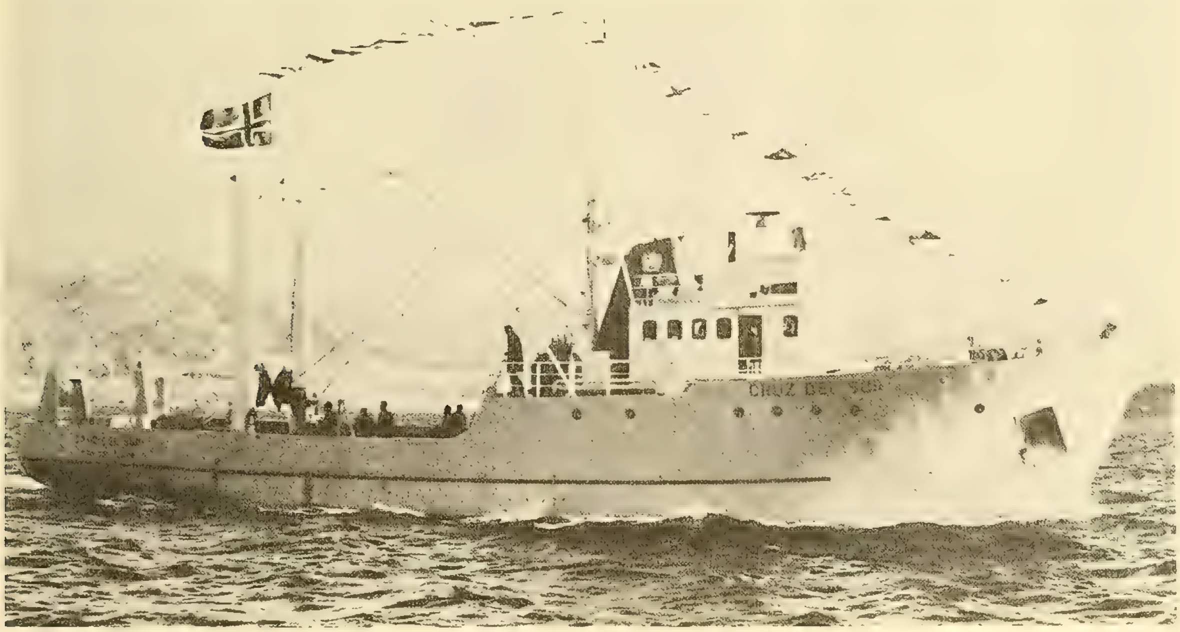
Since the completion of the work reported here, a centrifuge designed specifically for the separation of crab meat from shell and tendon has been designed and constructed. This machine is being tested at the Fishery Products Technology Laboratory at Gloucester, Massachusetts. The results of early tests are highly favorable and show that the new centrifuge produces a considerably better product than that produced by the centrifuge used for tests carried out in Seattle.

VESSELS OF FAO FLEET

Three of the nearly 100 FAO vessels searching for food the world over are pictured here. (See also CFR, April 1971.)

The 56-foot, British-built 'Fregata' is one of 3 FAO vessels to dramatically change the Caribbean fisheries. The other 2 are the 81-foot twins, 'Alcyon' and 'Calamar', built in Japan in 1966 to cross Pacific under own power. (FAO photos)





Since its 1968 launching, the 102-foot 'Cruz Del Sur' has set fishing records, reports Argentina. The vessel operates from Mar del Plata as a combination stern trawler and purse seiner.

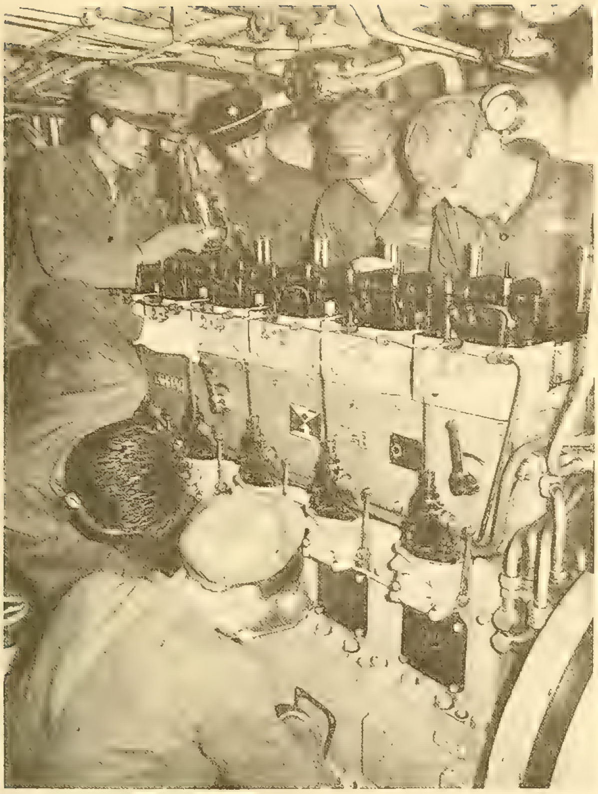
FISHING-TRAINING VESSEL

Two Japanese-built fishing-training vessels are training young South Koreans to increase their country's production. The 2 are: 'Chin Dal Le,' a 320-ton tuna longliner, and stern trawler 'Kaenali'.

The vessels sail from Pusan Deep-Sea Training Center, a $2-million, 5-year project sponsored jointly by UN Special Fund and Korea, and FAO administered.

Pusan Center graduates are becoming backbone of growing high-seas fleet.

The 'Chin Dal Le', which means 'wild rose' in Korean, is combination training vessel and tuna longliner. It carries 16-man crew, 40 trainees, and FAO instructors on 4-month trips. It fishes rich tuna grounds near Samoan islands.



Trainees in engine room
of Chin Dal Le.

Trainee at the bridge.

Kare Larssen of Norway, FAO officer,
inspects repairs.

(FAO: P. Boonserm)

FAO GROUP APPROVES INDIAN OCEAN FISHERY PLAN

A 5-year plan to develop Indian Ocean fisheries to help feed millions of Asians has been approved by the Executive Committee of Indian Ocean Fishery Commission. The commission is a 26-nation FAO regional body. The committee met in Rome April 26-29.

The program provides for a comprehensive effort to develop these fishery resources by developed and developing countries, and by international agencies, such as U.N. Development Program (UNDP).

Indian Ocean's Vast Potential

A 78-page report emphasized the vast potential of the Indian Ocean, which covers a fifth of the world's marine area. The ocean's annual yield is 2.4 million metric tons of fish. This could be increased to 14 million tons using existing technology. The world catch of marine fish is just under 60 million tons.

Annual growth rates of 5% to 8% over 20-year periods were foreseen for bottom (demersal) and open-water (pelagic) fisheries. In tuna and shrimp fisheries, already well developed and enjoying strong international demand, the full potential could be achieved in 10 years. The total potential yield was valued at about US$1.8 billion a year at retail level.

Benefit Billion People

The billion people of the Indian Ocean countries--about a third the world population--would benefit. East Africa and southern and southeastern Asia have substantial protein deficits. Population growth is higher than elsewhere. Per-capita national incomes vary from under $100 to $500 a year.

Fisheries would provide valuable protein food for local use and for export, especially tuna and shrimp. These would bring more jobs and investment opportunities.

Program's First Objectives

The program calls initially for technical staff under Indian Ocean Fishery Commission. It would identify and coordinate existing development projects and promote the gathering of statistical information. It would help launch national and regional projects: exploratory fishing, fishermen training, and introduction of better methods of fish handling, distribution, and marketing.

Other Indian Ocean Projects

FAO already is carrying out fishery development projects in Indian Ocean region. Also, studies are underway or being planned along coast of Tanzania, Gulf of Jeda in Saudi Arabia, Seychelles Islands, and Maldive Islands.

FAO REVIEWS SIGNIFICANT FISHERY DEVELOPMENTS SINCE 1958

FAO has reviewed the significant developments in sea fisheries since the first UN Conference on the Law of the Sea in 1958. World fisheries have been developing rapidly. The production of marine fish (including shellfish) increased from 27 million tons in 1958 to 56 million tons in 1969. Problems of overexploitation have intensified. This has increased the need for conservation and management measures.

In 1955, virtually all fish stocks outside the North Atlantic and the North Pacific were underexploited, or not exploited at all. Now there are few stocks of fish readily caught and marketed that are not heavily exploited. Many of these are caught by large fleets of long-range vessels capable of fishing anywhere.

The number of countries fishing well beyond their own coasts also is increasing. It includes several developing countries, often as a result of assistance programs. This is an important development since the 1958 Conference because more countries with strong and sometimes conflicting fishery interests will take part in the new conference in 1973.

Many Resources Underexploited

Though many of the more valuable stocks are overexploited, some seriously, the sea's total living resources are still underexploited.

According to the FAO Perspective Study of World Agricultural Development, the total demand for fish for humans and for animals is projected at 74 million tons in 1975, and 107 million tons in 1985. This compares with an estimated potential from conventional marine species of a little over 100 million tons.

Among the policies required to reach such a target, the study emphasizes the importance of management measures aimed at more rational use of fish stocks. This is because the full potential can be achieved only if each stock is harvested at optimum rate.

More species are being fished, so management has to account more for ecological interactions between different species in same region. Effective use of fish resources requires more than maintaining at high level the yield from certain individual stocks.

Particularly for capital-scarce developing countries, the costs of harvesting must be kept low. There is increasing emphasis on economic considerations in management schemes of governments either individually or within regional fishery bodies. The introduction of certain restrictions on fishing will not necessarily be economically beneficial. Some limitation of entry into a fishery is required if fisheries are to be exploited most profitably.

Many Improvements

Improvements in fishing equipment and methods, fish handling and processing, and development of new products and markets since the first conference have brought more resources within range of commercial exploitation; they have led to important cost reductions. Technical progress, however, has not always been an unmixed blessing for fisheries--because it is accompanied by intensified exploitation.

Fish Location

The most important developments probably have been in fish location, particularly in sonar in purse seining and aimed trawling. The industry also has adopted new fishing gear and gear-handling techniques, such as midwater trawls, mechanized devices for net handling, and fish pumps. The generalized use of synthetic fibers for net construction has had a significant impact on the development of fisheries.

New freezing and processing techniques make it possible to handle and store fish on board. A large fleet of freezer and factory trawlers has been built and equipped to operate anywhere. Other characteristics of the long-range fishery are mothership operations, with one large factory vessel supported by smaller catchers, and a worldwide network of fishing ports for unloading, bunkering, repair, or exchange of crews. In the traditional small-scale fisheries, the most significant changes have been the use of synthetic fibers, mechanization of small craft, and the use of glass-fiber and ferro-cement as hull material.

Other Developments

There have been developments in other uses of the ocean, including waste disposal, and in industrial exploration and exploitation of resources of seabed and its subsoil. Many of these activities affect fishery resources and fishing activities. This increases possibility of conflicts between various uses. It becomes necessary to consider measures required to minimize any harmful interference with fishing, especially from pollutants.

More Known Today

Today, scientists know much more about the sea's living resources, and the effects of fishing on them, than they knew in 1955. Many species migrate. Fishing them in one national jurisdiction affects them in other jurisdictions and on the high seas. There is need for an integrated approach to management.

FAO Committee on Fisheries

In 1965, FAO Committee on Fisheries was set up. It is the only global forum concerned with the development of fisheries. One of its main functions is to review fishery problems of an international character. It appraises the problems and possible solution in order to concert action.

More Management Bodies

More fishery management bodies have been established to cover specific areas of the high seas or species: the Joint Commission for Black Sea Fisheries; the Northeast Atlantic Fisheries Commission; the Joint Commission for Fisheries Co-operation; the Japan-Republic of Korea Joint Fisheries Commission. The Regional Fisheries Advisory Commission for the Southwest Atlantic, the Fishery Committee for the Eastern Central Atlantic, and the Indian Ocean Fishery Commission were created within the framework of FAO.

FAO also convened two Conferences of Plenipotentiaries that adopted Conventions for establishing, outside FAO, the International Commission for the Conservation of Atlantic Tunas and of the International Commission for the Southeast Atlantic Fisheries.

Regional fishery bodies promote and coordinate research and ensure rational management of resources in their area of competence.

JAPAN

FROZEN SHRIMP MARKET FORECAST FOR DECADE

Japan will have to import an estimated 120,000 metric tons of frozen shrimp by 1980 at twice the average 1968 price (US$2,217 per metric ton). The cost: about a half billion dollars. This was predicted in a report, "Frozen Shrimp Import Vision," prepared by an advisory body of Ministry of International Trade and Industry.

This is a summary:

Demand Trends: Demand for shrimp is rising rapidly. During 1966-1970, annual growth averaged about 9%. If trend continues, demand likely will increase to 122,000 tons in 1975, and to 156,000 tons in 1980.

Price Trends: Demand is increasing faster than supply. There is "excessive competition among Japanese shrimp importers." So it is estimated that prices will double by 1980 over 1968 prices.

Production: More shrimp grounds can be developed and harvesting methods improved. Unloading facilities at many fishing ports still inadequate. Processing facilities and quality standards in southeast Asia and Middle East are poor; only India and Australia have quality control.

System of Exports in Producing Countries and Imports by Japan: Exports in most shrimp-producing countries are handled by processors, not by export agents. Few governments are involved in administering exports. In Japan, quality standards are relatively uniform for frozen shrimp imports; about 70 importers are involved.

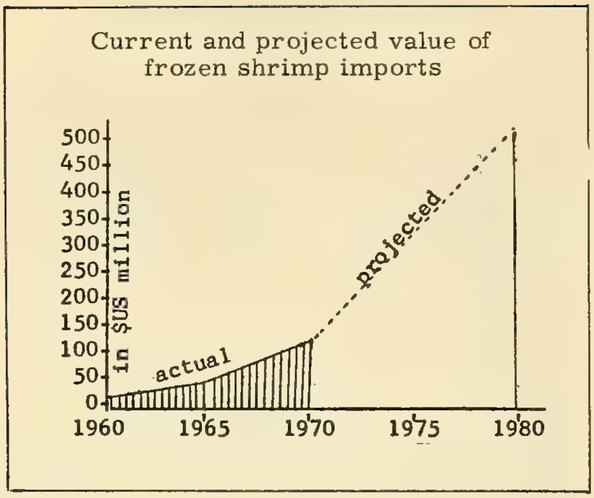
Resource Underused: Despite many rich grounds, the resource is not used effectively because of inadequate surveys. Japan must assist others financially, technically, provide vessels, gear, and train fishermen.

Quality Improvement: The following measures are needed in producing countries and in Japan: (1) complete removal of heads from shrimp aboard vessel, and use of ice to store catch; (2) construction of cold storages at ports of landing; (3) refrigerated railcars and trucks for land transportation; and (4) thorough export inspection.

Import Cost Reduction: To increase shrimp imports, Japan must reduce costs: (1) remove import tariff; (2) reduce ocean freight (very high); and (3) buy at reasonable price.

Establish Order: Raw material prices zoom whenever importers concentrate heavily in certain areas and bid up prices. These measures are necessary to avoid excessive competition: (1) develop uniform purchase contracts; and (2) work with industry to improve quality.

Government Measures Needed: (1) Eliminate import tariff on frozen shrimp; (2) provide more financial help to firms losing money developing resources in foreign countries; (3) more loans for resource development and for frozen-shrimp imports; and (4) help with surveys and technical problems. ('Shin Suisan Shimbun Sokuho', Apr. 28; 'Nihon Suisan Shimbun', Apr. 26.)



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WILL AID PERU'S FISHERY RESOURCE DEVELOPMENT

Major Japanese firms, including Mitsubishi Shoji and Mitsui Bussan, plan to help develop Peru's shrimp, crab, and coastal resources and modernize the fishing industry. The Japanese-Peruvian plan was disclosed by Fisheries Minister Tantalean during his visit to Japan as a guest of fishery and trading firms.

The Plans

Plans include capital investment of over US$10 million, jointly by Mitsubishi Shoji and Nihon Hogei, and similar investment by Mitsui Bussan. The operation will develop fishery resources and handle freezing, processing, storage, and export of fishery products.

Also planned are fishing bases and shipbuilding facilities to modernize the industry.

Although Peru harvests mostly anchoveta, its other coastal fishery resources, such as shrimp and crabs, are almost untouched. Japan plans to develop those resources by providing capital and up-to-date fishing techniques. ('Minato Shimbun', May 2.)

* * *

SHRIMP CATCH OFF GUIANAS INCREASES

The Japanese shrimp fleet fishing off the Guianas in South America consists of 70 trawlers owned by 7 firms and is based at Georgetown, Guyana; Paramaribo, Surinam; and Port of Spain, Trinidad.

The catch was 1,630 metric tons in 1968, 2,500 tons in 1969, and 3,839 tons in 1970. Of the 70 trawlers, only 10 of the 15 owned by Shinyo Gyogyo are licensed by Japan for regular commercial fishing. The other 60 are fishing "experimentally" under a 1-year renewable permit. The shrimp is processed in Georgetown and exported to the U.S. and Japan.

Plans for Joint Ventures

In Dec. 1969, the 7 Japanese firms formed the South American Marine Development Co. with authorized capital of US$278,000 (100 million yen), and paid-up capital of $69,400 (25 million yen).

The company was negotiating with the Guyanan Government and the British-owned Guyana Industrial Holding Co. to establish a joint shrimp freezing and processing plant in Georgetown. Guyana has one freezing plant: Bookers Merchants Ltd, 100% Guyanan-owned and operated, with a daily capacity of 30,000 pounds.

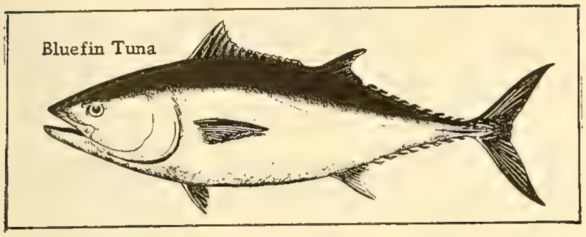
Similar negotiations were under way in Paramaribo, Surinam. The proposed undertaking there will not be possible until after Nov. 1971, when the exclusive processing rights held by Surinam-American Industries Ltd. (SAIL) expire.

SAIL built a freezing and processing plant in 1956 and obtained a 15-year exclusive concession to export shrimp from Surinam. The plant, rated very good, has a daily freezing capacity of 55,000 pounds. SAIL processes catches of Japanese shrimp fishermen under special agreement prior to export to Japan. ('Suisan Shuho')

* * *

CATCH OF SOUTHERN BLUEFIN TUNA WILL BE REGULATED VOLUNTARILY

The Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN) and the Japan Tuna Fisheries Association (NIKKATSUKYOKAI) have agreed on voluntary measures to protect stocks of southern bluefin tuna (Thunnus maccoyii).



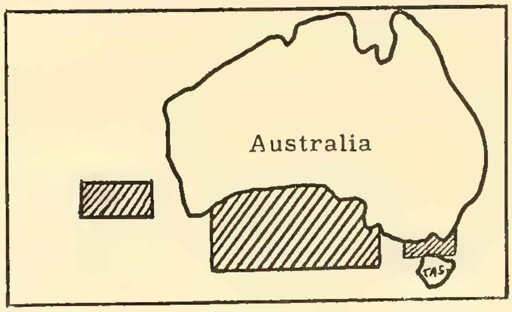
The plan will go into effect on or before Oct. 1, 1971. It will include a closed season in these areas:

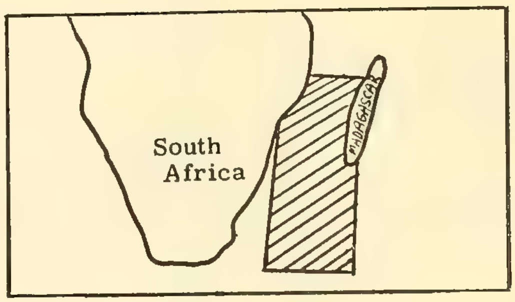
Between 120° E. and 140° E. longitudes, and between 40° S. latitude and Australia:	Oct. 1 - Mar. 31
Between 95° E. and 110° E. longitudes, and between 35° S. and 40° S. latitudes:	Dec. 1 - Mar. 31
Between 145° E. and 151° E. longitudes, and between 35° S. and 40° S. latitudes:	May 1 - July 31
Between 15° E. and 35° E. longitudes, and between 38° S. and 45° S. latitudes:	Oct. 1 - Jan. 31

The decision to establish voluntary industry regulation is important in promoting rational use of the resource. It was due partly to disclosures by the Government's Far Seas Fisheries Research Laboratory at Shimizu that southern bluefin resources might be depleted in South Pacific, Indian and Atlantic Oceans if fishery continued. Normally, 150-200 tuna longliners fish year round for the species.

Rapid Catch Drop

During past 3 years, the average daily catch has decreased rapidly. Off Australia, catches dropped from 3 metric tons in 1968 to 0.7 ton by Feb. 1969. Off Tasmania and New Zealand, the average daily catch decreased from 10-20 tons in early 1960s to less than 1 ton in 1970.





In 1971, the laboratory called for drastic measures to preserve the species because it takes 6-7 years for southern bluefin to reach adulthood. ('Suisan Tsushin' and 'Katsuomaguro Tsushin', May 17; 'Suisancho Nippo', April 16.)

MAY REDUCE SAURY FISHERY OFF U.S. WEST COAST

The Japanese have had little luck with saury fishing off the U.S. West Coast since they began exploring these waters in fall 1969. It has dampened their interest.

In 1970, the Japanese Fisheries Agency received applications from more than 50 vessels. Only 33 received permits, and only 15 actually fished. The deadline for filing was May 31, 1971, and only a few applications had been received a month before deadline.

First Vessel's Plan

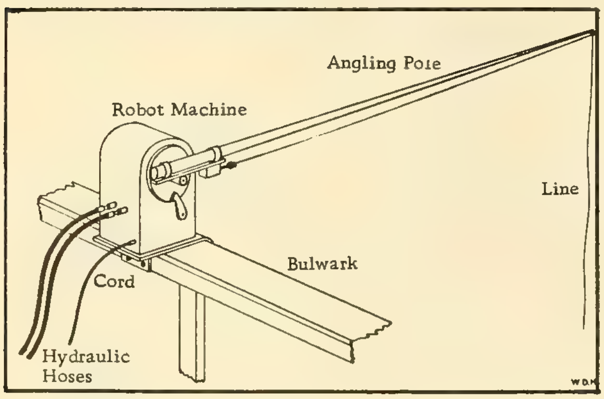
The first saury vessel, Nihon Suisan's 'Tone Maru', 535 gross tons, was scheduled to leave Hakodate in late June. In 1970, the vessel used a modified "boke-ami" (stick-held dip net). In 1971, it will use a fishing method combining stick-held dip net with "hiki-ami" (a type of drag net).

The Tone Maru plans to fish eastwards from central Pacific towards San Francisco, then proceed northward. ('Suisan Tsushin', Apr. 28.)

* * *

AUTOMATIC SKIPJACK-TUNA FISHING POLE IS SUCCESSFUL

The automatic skipjack-tuna fishing gear developed in 1970 by Suzuki Ironworks is proving successful in trials conducted by bait boats. Previously, small vessels were considered unsuitable for mechanized fishing; now they are experiencing amazing results with the automatic gear. Its use is spreading in Japan.



Robert skipjack tuna angler based on the drawing by the manufacturers, K. K. Suzuki Tekkojo, 7, Mikawa-cho, Ashinomaki, Miyagi Prefecture, Japan.

Fishing Effective

Ordinarily, 4 to 8 units are installed aboard a vessel. But one 384-ton vessel scheduled for launching in Oct. 1971 will be rigged with 16 units.

With proper chumming, fishing with the automatic gear is highly effective. The unit can lift albacore of 16-20 kilograms (35-44 pounds) the way skipjack are poled by hand.

The Federation of Japan Tuna Fisheries Cooperative Association is considering the effect widespread use of such gear would have on wage structure. It is studying proper wage scales for fishermen. ('Katsuo-maguro Tsushin', April 26)

* * *

SARDINES RETURN TO NIIGATA AFTER 15 YEARS

The Igarashihama port, in Niigata City, bustles as fishermen haul in large sardine catches. Sardine had all but disappeared from Japanese waters. The catch by about 15 boats on May 13 was large enough for fishermen to be jubilant. It was the largest in 15 years. ('Yomiuri', May 14.)

NMFS Comment: The 15-vessel catch does not seem large. The Sea of Japan sardines, which "disappeared" mysteriously after World War II, may be making a comeback. The same may be happening off the Soviet coast, where a sardine fishery flourished 20 years ago.

* * *

SALMON INDUSTRY AGREES ON 1971 PROFIT SHARING

On May 5, Japanese salmon-catcher owners and mothership operators agreed on distribution of proceeds during 1971 season. Terms include: (1) 63.5% of net proceeds will be for catcher vessels and 36.5% for mothership firms (62% and 38% in 1970); (2) the two groups will consult on selling prices and domestic sales; (3) a sales committee will be formed to improve sales system. Item 3 was

JAPAN (Contd.):

inserted because of poor 1970 salmon market in Japan. This had resulted in delays by several mothership firms in settling accounts with catcher vessels.

1970 Joint Fishing Management

In 1970, the two groups had agreed to joint management of fishing operations to provide more equitable profit sharing. Before that, the salmon fishermen had concluded predeparture price agreements each year. ('Suisan Keizai Shimbun', May 10.)

* * *

FRENCH ORDER JAPANESE SEED OYSTERS

French oystermen in the Charante area have ordered more than 50 tons of seed oysters from Japan. They hope the strain will prove more resistant than the French oyster to the mysterious disease expected to destroy over 50% of 1971 crop in Vendee region of northwest France. French oyster culture annually produces US$2 million worth.

Oyster Breeders Warned

Claude Maurin, Director of France's Technical and Scientific Marine Fishing Institute, has warned French oyster breeders against importing Japanese oysters to replenish their beds of Portuguese oysters hit by a mysterious disease in 1971. He said: "Although the Japanese variety grows more rapidly, it runs the danger of adversely affecting its marine environment for it filters more and consumes more. . . . Above all we must avoid an ill-timed reseeding." ('Japan Times', May 3.)

* * *

BRAZIL'S 200-MILE FISHING ZONE WILL HURT JAPANESE SHRIMPERS

Brazil's recent extension of her territorial sea to 200 miles will seriously hurt the Japanese shrimp fishery there, Japanese sources say. Some 72 shrimp trawlers of South American Marine Development Company (SAMDC), formed by 7 Japanese firms, annually catch off northeastern coast of South America about 3,000 tons (headless weight) of shrimp worth about US$11.1 million.

30% Within 100 Miles

About 30% (900 tons worth about $3.3 million) comes from within 100 miles of Brazil's coast; according to new regulations, only Brazilian vessels may fish there.

SAMDC has asked Japanese Government to negotiate with Brazil to ensure continuation of shrimp fishery in those waters. ('Suisan Tsushin', May 27.)

* * *

TO FISH SKIPJACK TUNA WITH AUSTRALIANS

The Kyokuyo firm plans a joint skipjack-tuna-fishing venture with Australia's Gollin Company in July 1971. Kyokuyo will put up 55%, and Gollin 45% of capital. Headquarters will be Port Moresby, Papua-New Guinea.

Plans in progress are for a canned tuna and "arabushi" (sun-dried skipjack loin) processing plant in Kavieng, New Ireland Island and, later, a cold-storage plant.

Preparation Underway

At present, Kyokuyo has 4 pole-and-line vessels conducting "exploratory" skipjack fishing from Kavieng. The vessels were landing 5-ton average and up to 20 metric tons per vessel per day's fishing. In June, two more vessels were scheduled to join fleet. By 1974, the fleet will be 15-16 vessels, including purse seiners; and annual landings are projected to 50,000 tons.

1966 Joint Venture

In 1966, the 2 firms formed Gollin Kyokuyo Fishing Co. to shrimp in Gulf of Carpentaria. The venture progressed steadily. In June 1970, the firm distributed 15% dividends to shareholders.

Scheduled for June 1971 was an increase in capital from present $56,000 to $400,000. In 2 years, the Gulf of Carpentaria fleet will be expanded from 10 to 15 vessels; annual landings are estimated to reach 1,000 tons. ('Suisan Keizai Shimbun', May 31.)

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JAPAN (Contd.):

FISHING FAMILIES DECREASE, OLDER FISHERMEN INCREASE

The number of fishermen in Japan is decreasing and their average age is increasing, according to Ministry of Agriculture and Forestry's survey: "Fishing Family Employment Situation in 1970."

In 1970, there were 363,100 fishing families (3.2% below 1969). These consisted of about 1,723,000 family members (down 5.4%).

The number of workers in the fishing industry was 691,400 persons, down 6.4%; of these, 548,700 (down 4.1%) were offshore workers.

Young Group Declines

By age group, the number of fishermen 15-39 declined more (6.1%) than those 40 and over. This indicates that proportion of older fishermen is increasing.

Among fishing families, junior high school graduates totaled 43,700--22,700 were males. Of male graduates, 40.7% advanced to higher schools, 55% chose work in fishing industry, and 4.3% was unemployed.

Among male graduates entering a fishing career, 12,485, only 4,000 became offshore fishermen. ('Shin Suisan Shimbun', May 17.)

TAIWAN

REMOVES IMPORT CONTROLS ON MARINE COMMODITIES

Taiwan's Bureau of Foreign Trade removed over 650 items from the controlled import list during Jan.-Mar. 1971. About 50 marine commodities are included. These now can be exported to Taiwan as "permissible import" items, including salted, dried, or smoked croakers, Spanish mackerel, tilefish, lizardfish, sea catfish, sauces, tortoise and mother-of-pearl shells, and seaweeds.

* * *

1970 CATCH ALMOST 10% ABOVE 1969's

Taiwan's 1970 catch was 613,000 metric tons, almost 10% above 1969's 560,000 tons. The largest increase was in fish culture, 27% more than 1969; the absence of typhoons and government programs helped to produce it.

The second largest increase came in distant-water fisheries (9%), especially from Taiwan-based vessels. Without these, there would have been no increase in distant-water catch because non-Taiwan-based fleet caught less in 1970 than in 1969 (93,000 vs. 94,000 tons).

Tuna Fleet Growth Slowed

In past years, tuna fleet grew fastest. But not in 1970. Tuna stocks probably were less available in 1970 than before. In heavily exploited waters off Taiwan, catch increases were held to about 6% in outer coastal waters, and only 2.5% in inner coastal waters, where pollution problems are beginning to be felt. ('China Fisheries Monthly', Feb. 1971.)

1971 Fleet Building Plans

Only moderate expansion of fleet construction is planned in 1971: 40 tuna longliners (250 GRT each).

The hulls will be constructed in Taiwan, the engines and other equipment imported. Delivery is expected at end of 1971. No more tuna vessels will be built for several years.

Construction of 12 pair trawlers (minimum 150-ton refrigeration capacity), partly financed by a $1 million government loan to fishing companies. Construction contracts have not been concluded. (U.S. Embassy, Taipei, April 15.)

EUROPE

USSR

1966-1970 SOVIET FISHERIES REVIEWED BY DEPUTY MINISTER

The Soviet Deputy Fisheries Minister has disclosed some of the accomplishments of Soviet fisheries during the 1966-70 Five-Year Plans (FYP).

The catch was 34 million metric tons (up 55% over 1961-1965), edible fishery products output 17 million tons, fish meal 1.7 million tons. In 1970, the catch was 7.7 million tons.

Among edible fishery products, fillet production increased the most (440% over 1961-65), canned products the least (48%). While catch rose 55%, per-capita consumption of fish and fishery products rose only 36.5%.

Three-fourths of all fish processing was done on the high seas. This is significant because it helps to maintain and improve the quality of fishery products.

1971-75 Plans

For 1971-75, Mr. Studenetskii indicated, the Soviets will move their fisheries away from the Continental Shelf into the deep oceans. This will require re-equipping the fleet with improved gear and building new vessel types.

Research

Mr. Studenetskii, a researcher, stressed the need for expanded and improved exploration and research for new species, fishing grounds, and better gear. He will push for more efficient and profitable techniques to fish sparsely schooling fish and other marine creatures.

Red Tape

It was apparent that red tape and other problems continued to plague the fisheries because the Deputy Minister said he planned to "weed out unnecessary bureaucracy," would demand the application of cost accounting at all managerial levels of the Ministry and industry, and pledged "improvement of quality and management of research" and planning for fleet operations. ('Vodnyi Transport')

* * *

SOVIET BLOC TO SURVEY VALUABLE MINERALS ON OCEAN FLOOR

The Soviet Union and its allies have agreed on a program to survey and extract valuable minerals on the ocean floor. At present, there is no international authority on the exploitation of seabed resources. The Soviet-bloc plan was reported from Moscow to The New York Times on April 23, 1970.

After a 4-day conference in Riga, Latvia, a Baltic sea port, the geologists decided to establish an International Coordinating Center of Marine Exploration in the Soviet Union.

The center will be designed to insure "rational use of mineral resources of the oceans." It will be open to members of the Council of Mutual Economic Assistance, or Comecon, the economic alliance of the USSR and Eastern Europe.

A published interview with G.A. Mirlin, head of Soviet delegation at Riga meeting, disclosed that joint expeditions are being planned to select possible sites for mineral exploitation.

Oil & Gas Fields

Mirlin heads the Geology and Mineral Resources Department of the Soviet State Planning Committee, the economic planning agency. He said that exploration would aim at finding oil and gas fields, and deposits of gold, nickel, tin, titanium, cobalt, and zirconium. The Soviet land mass has limited supplies of these.

The Soviet bloc action comes after the UN General Assembly agreement in December 1970 that the seabed's riches belonged to all nations. The assembly adopted a resolution creating an international body to direct exploitation efforts.

The resolution calls for a law-of-the-sea conference in 1973 to write governing regulations. The conference will try to agree on a definition of the seabed area that would be outside national jurisdiction and under the proposed world authority.

Published reports of the Riga conference did not mention UN efforts to regulate use of seabed resources.

The conference was attended by delegations from the USSR, Hungary, East Germany, Poland, Bulgaria, Rumania, and Czechoslovakia.

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USSR (Contd.):

FISHERIES MINISTRY'S COMPUTER WATCHES FLEET OPERATIONS

The Soviet Fisheries Ministry's Main Information Center in Moscow has a huge, electrically illuminated world map divided into 22 squares. These represent the principal Soviet fishing grounds. The Center follows Soviet fisheries in all oceans. It can tell positions of fleets or individual vessels at any time.

The Ministry's control room is connected by teletype with the headquarters of the 5 Main Fishery Administrations all over USSR. A computer stores information fed daily by the Main Fishery Administrations on fishery operations. The computer also is fed data on vessels in ports or en route to the grounds. The data, retrievable instantly, are transferred to the map for visual examination.

Worldwide Hookup

The Director showed a Moscow reporter the efficiency of his Center by projecting on the map the exact location of the Soviet Far Eastern (DAL'RYBA) fleet in the Sea of Okhotsk; the Northern Administration (SEVRYBA) fleet in Barents Sea; the northwest Atlantic (off Labrador and Nova Scotia), and around the Azores--with catch data for that day.

The center is in constant radio contact with all major Soviet fishery vessels. During the interview, the Director established voice contact with captain of whaling factoryship 'Sovetskaia Rossiia' in the Pacific en route to Vladivostok.

Center Fully Operational

The Main Information Center was established in 1969 as part of the Ministry's Division for Coordination of Computer Operations. It is fully operational. Experimental computing centers in the USSR's Main Fishery Administrations are feeding the Main Center with data on fleet operations, catch, and catch projections.

NORWAY

NORDIC GROUP EXPANDS FOREIGN MARKETS FOR FROZEN FISH FILLETS

Sales of frozen fillets to the U.S. by the Nordic Group have increased considerably, reports its director. The group is composed of 13 independent fish processors in Norway. In mid-March, indications were that 1971 sales would reach 20,000 metric tons, compared to 13,000 tons in 1970.

The Nordic Group was granted Norwegian export rights in April 1968. It packs under the labels of several U.S. processors.

Frionor, which packs under its own label for shipment to its plant in New Bedford, Mass., sold 30,000 tons to the U.S. in 1970.

The director also reported considerable progress in exports to the U.K. ('Fiskaren')

SWEDEN

IMPORTS OF FISHERY PRODUCTS ROSE IN 1970

In 1970, Swedish imports of fishery products increased to 81,000 metric tons worth US$73 million--up 5,370 tons and $13 million over 1969.

Imports of fresh fish decreased 500 tons to 12,500 tons; their value rose $0.2 million to $8.5 million. Frozen fish in the round reached 4,600 tons valued at $7.6 million, up $1.1 million.

Salmon was more than $9 million of total fresh and frozen imports of $16 million. Other leading imports were halibut, plaice, ling, and mackerel.

Another large import item was frozen fillets, 17,000 tons worth $12 million--2,700 tons and $3 million above 1969.

Canned Shellfish No. 1

The largest share in import value was canned shellfish (5,600 tons) worth $13 million; this was increase of $5 million from 1969. Imports of shrimp were $7 million, and crabs almost $3 million. ('Fiskets Gang', Apr. 1971.)

ITALY

TUNA SALES FROM JAPAN ARE AT A STANDSTILL

In early April 1971, Italy established a provisional mercury guideline of 0.7 part per million, plus a 10% allowance--maximum limit of 0.77 p.p.m.--for all fresh, chilled, or frozen tuna imported into Italy. A 3-month trial inspection period was begun. From then until mid-May, the Japanese had not received a single inquiry for tuna from Italian packers.

Italian Market Uncertain

The uncertainty of the Italian market may soon affect Japanese, South Korean, and Taiwanese fleets fishing for yellowfin in the Atlantic Ocean. These fleets switched from albacore to yellowfin in Dec. 1970 following the discovery of mercury in canned tuna in the U.S. Large quantities of tuna, already aboard, were due to be unloaded in Italy in late May and in June. Fleet owners feared that a sharp price decrease in Italy would adversely affect the profitability of Atlantic operations. ('Suisan Tsushin', May 11.)

Fish stall in Rome Market. (Robert K. Brigham)

BRITISH SHRIMPING DWINDLES, PUZZLING FISHERMEN AND BIOLOGISTS

Bernard Weinraub

The shrimps are barely running on Britain's northwest coast.

Along the jagged 500-mile stretch from Silloth to Rhyl in North Wales--which accounts for half the country's shrimp yield--the rubber-booted fishermen are returning glumly each morning with either empty nets or just a few pounds to sell to local tradesmen.

"Disastrous, it's absolutely disastrous," said Alan Spencer, managing director of one of the area's chief shrimping cooperatives, Lytham and Morecambe trawlers. "Normally in this spring run we'd have caught five tons of peeled shrimp by now. Well we've caught only a ton so far."

Across the entire northwest coast, less than two tons of peeled shrimps have been caught during the current spring season, which runs from March to May. Last year the figure was 8 to 10 tons. Shrimps are normally most profuse in the late autumn from September to December. Last year 125 tons of peeled shrimps were caught in the autumn season, compared with 250 tons in the previous year.

Fisherman here refer to the shrimp as "peeled" or "picked," because the shells are quickly removed by local workers after the catch is hauled on to shore and weighed. One ton of peeled shrimp is about the same as four tons of "rough shrimp," whose shells have not yet been removed.

Biologists Move In

Teams of biologists have moved into the towns of gray stone houses and cobbled streets to check the waters of the surrounding Irish Sea for pollution. The biologists, of the Ministry of Agriculture as well as the Lancashire and Western Sea Fisheries Joint Committee, express confusion.

"The shrimp landings have been declining over the past year and the decline is widespread but we have no evidence of simple pollution," said A. J. O'Sullivan, a senior biologist with the fisheries committee, which is the offshore protection and conservation body. "If the decline was caused by a pollutant then I expect the effects would be quite severe in areas where the pollutants are in effect."

"But the decline is too widespread," he said. "We're thinking now that this could be a natural low period for shrimps and the general pollution in the area is decreasing their viability even more. We're thinking that this natural low period is being accentuated by pollution-induced effects."

In the tiny office of the shrimp cooperative in Lytham, 220 miles from London, Mr. Spencer shook his head and said: "No, we don't think it's due to direct pollution. Whether it's due indirectly to pollution is something else. It may be that pollution has killed off the weeds in the grass that the shrimps

feed on. It may be that pollution has killed off a certain amount of oxygen."

Although the northwest coast yields about half of Britain's shrimps--the rest are produced in The Wash, a broad inlet on the east coast--housewives and restaurants will not suffer since most of the shrimps eaten here are imported. The total amount of shrimp production in Britain is valued at about \$480,000. Imports of frozen shrimp are worth \$4.8-million while imports of canned shrimp amount to \$6-million.

Mysterious and Confusing

What worries the biologists is that the causes of the skimpy shrimp harvest remain mysterious and somewhat confusing. What worries the fishermen here is that business keeps falling and unemployment climbs. Between 800 to 1,000 shrimp processors and fishermen have been laid off, including hundreds of part-time "pickers" who peel the shells. Some have been hired to work in the small "bed and breakfast" hotels in nearby Morecambe Bay, a summer golf and seaside resort.

The gloom around Morecambe Bay has deepened even further by the failure of the whitebait--young herring--catch this season, the secondary delicacy on the coast and a favorite appetizer in British restaurants.

"I've got orders for 16 tons of whitebait but so far this season we've seen only 90 pounds," Charles Bartle, manager of the Flookburgh Fishermen's Association, said, walking near the chilly surf in Flookburgh, 40 miles north of Lytham.

"Last year, the year before, we'd catch a ton each day, we'd have to ration the men," said the gray-haired fisherman.

"I'm 59 years old," he said. "I've been in this business all my life but I've never seen anything like this."

Evidence of the gloomy fishing season here is everywhere: the men sit in pubs in Lytham and Flookburgh at mid-day; the \$17-a-week part-time shrimp pickers, mostly women, stand in the spotlessly clean processing rooms of factories in Lytham, bored at the absence of anything to do.

"Every day people go out two hours after high water and hope, you know, that this day will be different but they come back with nothing," said Bill Irving, a solemn, gray-haired fishing manager from northern Silloth. "It's eight hours out there and bloody nothing and it's been like that for too long now."

Reprinted from The New York Times, May 30, 1971.

TO BRITISH FISHERMEN, TRADE BLOC IS NO PRIZE

Anthony Lewis

ALDEBURGH, England. In this North Sea village you can buy your fish direct from the fishermen, at little huts on the rocky beach. W.V. (Billy) Burrell sells skate, sole, lobster, crab. On the side of his hut, just over the pile of crabs, is a sticker: "Common Market? No." That is probably a fair reading of the state of mind in Aldeburgh and all around this beautiful bleak old part of England, the bulge of East Anglia into the sea. People are talking a lot about the Heath Government's effort to bring Britain into the European Common Market, and no one sounds happy.

Billy Burrell, 46 years old and rugged, looked up from the lobster pot he was mending and explained that for him it was strictly a matter of economic survival.

"This is one of the finest fishing grounds about," he said. "As it is, there are boats from all over just beyond the 10-mile limit--Polish, German, French, Spanish, Portuguese, Belgian.

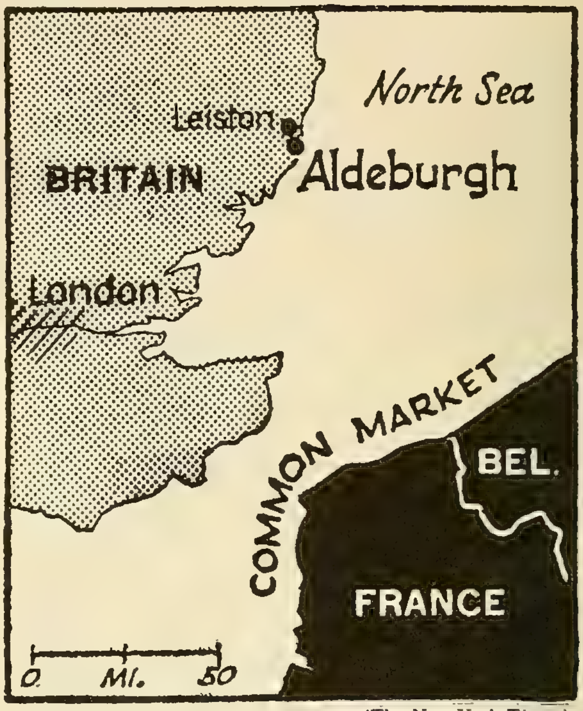
"If we get into the Common Market, you know they are going to come on in. With our little boats, we'll be in trouble."

The Aldeburgh fishermen go out in small open boats--18 feet long, but with so much ballast to cope with the rough water that they weigh two tons. There is no harbor; the boats are winched right up on the beach.

"There are not enough fishermen in Aldeburgh to get in the paper," Mr. Burrell said, but it's been going on from father to son a long time, catching fish the same way.

"I work 7 days, 18 hours a day. I'm not complaining. We get our living--a good living. But it's our livelihood that's at stake."

In fact, the British Government is far from oblivious to the fishermen. Their worries are a major issue for the next and, it is hoped, the last round of the Common Market negotiations to be held in Luxembourg. The Government is insisting that British fishermen be allowed to keep exclusive rights out to a six-mile limit.



(The New York Times)

Would a regulation like that satisfy Mr. Burrell?

"Yes, I think so. And I believe they will have a regulation. It's only as it affects our livelihood that I object."

Not everyone is so moderate about it, so ready to adapt. Tim Forge, co-director of the Uplands Hotel, makes clear that it is a philosophical matter with him. Mr. Forge, 65, was a rugby star, a schoolmaster and a tea planter in Assam before he got into hotels.

Did he agree with the objectors?

"Yes," the vicar said. "I feel strongly in sympathy with them. I think if it does happen, it will be the end of the Conservative party as we know it."

"This part of England has been invaded 11 times, you know, and people don't like strangers much," he added.

Reprinted from The New York Times, June 16.

But wasn't the last of those invasions hundreds of years ago?

"Yes," he said, "but you have to live here a time to know how people still feel about it. They have long memories."

It is hard to say how many are really irreconcilable, how many looking for reassurance from the Government. But there clearly are a lot of people who are ready to be persuaded.

On the road from Aldeburgh, at a railway crossing in the village of Leiston, was James Callaghan of the Labor Party, a critic of the market, who was speaking to a handful of the faithful in the pouring rain.

On the fringe of the small crowd two housewives who did not give their names said it was prices that worried them about joining. But they thought it was probably going to happen anyway; they just wished Prime Minister Heath or someone could explain it better.

The other big subject of conversation around here, unavoidable at this time of year, is the Aldeburgh Festival. That again is not only an international musical event but something intensely local, intimate, with the flavor of this fishing village.

Billy Burrell has known the festival's inspirer and director, Benjamin Britten, for many years and, through him, others who have taken part. E.M. Forster, who worked on the libretto for Britten's opera "Billy Budd," used to spend weekends in the Burrell home.

"I knew Forster 25 or 30 years," Mr. Burrell said. "He was one of the best, always willing to listen. A man so great and yet so humble--nothing put on, on his side or mine."

"Peter (Pears) and Ben are the same--they've never got above themselves," he continued. "My son is a godson of Ben's. I remember he gave me a copy of the "Billy Budd" score, inscribed: 'To Billy B., for B.B., from B.B.'"

Each plastic fish box aboard this small English vessel holds 50 kilos.

SOLE FOOD--SPECIALTY FOR SLIMMERS

Diet time can be pleasure time with fish and shellfish on the menu. All fishery products offer high nutritive values and most of them are low in fat and calories. Fish fillets are especially appropriate for dieters because they can be easily portioned to conform with diet plans. And they are readily available either fresh or frozen.

Sole fillets are fine eating with firm, white, delicately flavored flesh. They cook quickly because they are rather thin and adapt well to rolling or stuffing. Sole fillets vary in weight from 2 to 4 ounces, occasionally up to 8 ounces. One might say that sole fillets are filler-slimmers because their high protein content fills you up while you are slimming down.

Sole are members of an amusing family of fish called flatfish, whose characteristics make them distinctive from other species. These funny fish, shortly after beginning life, change from the average fish shape to a flat shape that, strangely enough, resembles a flying saucer. Their bizarre shape, however, does not alter their wonderful taste or exceptional food values.

Saucy Sole, a National Marine Fisheries Service recipe, presents the fillets broiled with a tasty sauce to keep them moist. The sauce, believe it or not, uses mayonnaise (diet) and chili sauce blended together with celery salt, dry mustard, and wine vinegar for added zest. About 8 to 10 minutes cooking is all that is needed, and this feast of Saucy Sole is ready to enjoy. So good--you'll forget that it's diet recipe until you remember the calorie content which is only an approximate 175 calories per serving.

SAUCY SOLE

- 2 pounds sole fillets or other thin fish fillets, fresh or frozen
- 2 tablespoons butter or margarine, melted
- $\frac{1}{2}$ cup low calorie mayonnaise
- 2 tablespoons chili sauce
- $\frac{1}{2}$ teaspoon celery salt
- $\frac{1}{2}$ teaspoon dry mustard
- $\frac{1}{2}$ teaspoon paprika
- $\frac{1}{2}$ teaspoon wine vinegar

Thaw frozen fillets. Skin fillets and cut into 6 portions. Place fish in a single layer on a well-greased bake and serve platter, 16 by 10 inches. Pour butter over fish. Combine mayonnaise and seasonings. Broil fish about 4 inches from source of heat for 5 minutes. Spread mayonnaise mixture over fish. Broil 3 to 5 minutes longer or until fish flake easily when tested with a fork. Makes 6 servings.

Live it up while slimming down--it's easy with seafoods! For 22 slimming moods with seafoods, send for "Seafood Slimmers," a NMFS full-color booklet designed especially for you, the dieter. For your copy, send 25¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 and ask for "Seafood Slimmers," Fishery Market Development Series No. 7 (I 49.49/2:7).

Also available, and this time it's free, is a colorful little brochure containing four slimming recipes from the well-known Weight Watchers International, Inc., as well as five Bureau seafood recipes. For your copy, write to Stay Slim, Texas Parks and Wildlife Department, John H. Reagan Bldg., Austin, Texas 78701. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio St., Rm. 526, Chicago, Ill. 60611.)

START CRABBING--THIS IS THE YEAR!

Mother Nature is in a bountiful mood--she has gone all out this year in providing a good supply of blue crabs for our eating enjoyment. Excitement is running high all along the Atlantic and Gulf coasts where fishermen are pulling the tasty crabs out of the waters of bays and sounds. Gourmets have their favorite recipes out, and crab kettles are steaming in readiness for these treasures. It isn't necessary to be a crabcatcher, however, in order to be a crabeater. Seafood markets will soon reflect this abundance and the succulent blue crabmeat will be readily available.

Blue crabs, named for the bright blue on the claws of the male crabs, are delicious eating and are an excellent source of high-quality protein, while being low in calories. Blue crabmeat is marketed already cooked, refrigerated, and ready to use in 12 or 16 ounce cans as lump meat, flake meat, a combination of lump and flake, and as claw meat. Blue crabmeat is also pasteurized, a method that gives longer shelf life without altering taste or texture of the meat. Pasteurized crabmeat must be refrigerated, however, until used. Hard-shell crabs are sold alive in some areas. Soft-shell crabs, relished by gourmets, are blue crabs in the molting stage when the hard shell is discarded in order for the crab to grow.

Crab Melon Ring Salad, a NMFS recipe is a summertime taste sensation. For this recipe and How To Cook Crabs (I 49.39:10) which describes the different kinds of edible crabs in the U.S. and gives information and recipes for preparing crabmeat, send 20¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CRAB MELON RING SALAD

1 pound blue crabmeat, fresh, frozen, or pasteurized, or other crabmeat
$\frac{1}{2}$ cup Lime Mayonnaise
6 cantaloupe or other melon rings
Salad greens
1 pint strawberries or other fresh berries
Frozen Lime Mayonnaise Flowers

Thaw frozen crabmeat. Drain crabmeat. Remove any remaining shell or cartilage. Combine Lime Mayonnaise and crabmeat. Chill. Place melon rings on salad greens. Place approximately $\frac{1}{3}$ cup crab mixture in the center of each ring. Cut large strawberries in half and arrange on melon. Place Frozen Lime Mayonnaise Flowers on top of crabmeat. Makes 6 servings.

Lime Mayonnaise

$\frac{1}{4}$ cup mayonnaise or salad dressing
3 tablespoons heavy cream, whipped
2 tablespoons lime juice
$1\frac{1}{2}$ teaspoons grated lime peel

Combine all ingredients. Chill. Makes approximately $\frac{3}{4}$ cup dressing.

Frozen Lime Mayonnaise Flowers

$\frac{1}{4}$ cup Lime Mayonnaise
Green food coloring

Combine Lime Mayonnaise and a few drops green food coloring. Spread $\frac{1}{4}$ inch thick in a small shallow pan. Freeze until firm. Cut into flowers. Makes 6 flowers.

(National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

INDEX

☆ U. S. GOVERNMENT PRINTING OFFICE : 1971 435-343/11

BACK COVER: Alaskan king crab on last leg toward the cooker at a Cordova, Alaska, plant.
(NMFS-Alaska Photo: J.M. Olson)

A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

COMMERCIAL FISHERIES Review

VOL. 33, NO. 6

JUNE 1971

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

National Marine Fisheries Service

U.S. DEPARTMENT OF COMMERCE
Maurice H. Stans, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Dr. Robert M. White	Howard W. Pollock	Dr. John W. Townsend Jr.
Administrator	Deputy Administrator	Associate Administrator

NATIONAL MARINE FISHERIES SERVICE
Philip M. Roedel, Director

COVER: Shrimp catch in Gulf of Mexico off New Orleans.

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the National Marine Fisheries Service (formerly Bureau of Commercial Fisheries).

FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

Editor: Edward Edelsberg

Production: Jean Zalevsky
Alma Greene

Throughout this book, the initials NMFS stand for the NATIONAL MARINE FISHERIES SERVICE, part of NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. Department of Commerce.

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CONTENTS

An Alaska fur seal family on St. Paul Island, Pribilof Group, Alaska. (Photo: V.B. Scheffer)

SEC. STANS REPORTS FAVORABLY ON SEAL HARVESTING IN PRIBILOF ISLANDS

Secretary of Commerce Maurice H. Stans reported, July 14, 1971, his conclusions on methods used to harvest seals after a visit to the Pribilof Islands off Alaska in the Bering Sea on July 8 and 9.

He went to observe fur-seal management, conservation practices, and to review harvesting methods because of recent criticisms.

He consulted with 6 veterinarians named by the American Veterinary Medical Association to study the harvest methods; the administration of St. Paul, the major Aleut community in Alaska, located on one Pribilof island; representatives of the American Humane Association, the International Society for the Protection of Animals, and the Humane Society of the United States, who were observing the harvesting; officials responsible for Canada's seal harvesting; the National Marine Fisheries Service, responsible for harvesting and preparing the seal skins.

The Secretary said: "The issue is not whether we will or will not continue to manage the fur seal herd. The issue is how we will manage the seal herds at their optimum levels most humanely."

The Secretary said present management practices were reached after the near extinction of the herd 60 years ago. If the internationally negotiated management program were stopped now, it would very likely result in the same catastrophic effects. These could include resumption of high-seas hunting with indiscriminate slaughter, and a very high mortality rate of the pups on shore.

STANS' CONCLUSIONS

"As a result of my meetings and my personal review of the situation," he said, "I can report the following conclusions:

"1. There is no molestation or harvesting of the female seals, the pups or the male bulls associated with the harems in the rookeries. The only harvesting that takes place is of male seals three or four years old who situate themselves at a distance from the breeding herds.

"2. Except for the fact that the operation takes place in the open, the method of harvesting is very similar to that which takes place in a meat-packing plant. The herd of male seals is removed about 100 yards from the beach, sorted into groups of from six to ten, and each animal in a group is then rendered unconscious by a quick blow to the head and immediately killed by bleeding. The entire process, including the skinning of the dead animal, takes about one minute.

"3. Investigations have been conducted over a period of years to determine whether or not there is a more efficient method of harvesting. None has been found. The six veterinarians on the spot have been asked by me to make any recommendations for a more humane method of harvesting, and their report will be made to me upon the completion of the assignment. If their scientific studies establish that a better method is practicable, it will be adopted.

"4. The annual period of harvesting and the number of seals harvested is determined carefully on a basis that will maintain the

population of the seal herd at its optimum level. As a result of this process, the number of seals on the Pribilofs is currently estimated at 1,300,000, compared to only 200,000 in 1911. There is no present danger whatsoever of extermination of the herd under these policies.

"5. The harvesting of the seals is the source of practically all of the income of the 700 Aleut residents of the Pribilof Islands. To deprive them of this income would make them dependent on the government. The local officials make it quite clear that they want the harvesting to continue so that the residents can earn a living and that under no circumstances do they want to move from the Islands.

"6. Any implications, such as those recently published, to the effect that baby seals are harvested, that harvesting is depleting the herd, that harvesting methods are inefficient or inhumane, or indiscriminate, are totally unfounded. The crop of these animals is being managed and harvested under scientific practices just as domestic animals are raised and harvested.

"Ending the program would not be in the interest of a sustained seal population, the Aleut workers, or the federal government. I repeat, if and when more humane methods of harvesting are found and satisfactorily tested, they will be adopted."

Secretary Stans noted the fur-seal management program is one of the most effective wildlife conservation and management programs in history.

NMFS STUDIES HEAVY-METAL CONTAMINATION OF FISH

NMFS scientists are working to define the nature and extent of heavy-metal contamination in fish found in coastal and offshore waters. The program involves 6 NMFS laboratories and the cooperation of other Federal agencies and the fishing industry.

The scientists are concerned over the decline in sales in New England of tuna and lobster. During the recent mercury scare, the two were withdrawn from the market for testing by Federal and state governments.

Fish eaters in New England have received strong assurances that they can buy with safety any fish item--swordfish excepted--from the shelves or in restaurants.

Swordfish was not included because the U.S. Food and Drug Administration (FDA), citing the too-high mercury content, warned the public not to eat it.

The NMFS research program has 3 phases:

1. In April, research vessels began gathering offshore species. Inshore gathering of shellfish and fish already was underway. Specialists will be trained for analytical work, highly specialized equipment set up for testing heavy metals, and fish samples submitted by commercial and sport fishermen cooperating with NMFS.

2. As many marine and freshwater fish as possible are being surveyed and tested in the laboratory. In 1969, the FDA set a maximum permissible limit of 0.5 ppm in food in a daily diet. Most scientists believe this criterion provides a considerable safety margin.

Another aim of the testing is to pinpoint the body parts that store and carry the contaminants. Questions that have to be answered include: Are metals isolated, or evenly distributed in all body parts? What is the significance of flesh color? Are size and weight of fish important factors? How do heavy-metal levels in the whole fish relate to product consumed? To answer this last question, 30 fishery products will be analyzed--such as fish sticks, fish portions, fish cakes, and fish for frozen dinners. Earlier this year, frozen fish blocks (compressed fish) were tested with very favorable results. The blocks are made from the edible portion of cod, haddock, flatfish, and pollock that run the North Atlantic waters. The U.S. consumes annually 270 million pounds, 98% imported from about 50 countries and processed in Massachusetts, Maine, and New Hampshire.

3. This phase is more complex. Existing garbage-dumping stations were selected along the coast from Connecticut, Long Island, south to Delaware. Fish and shellfish taken shoreward from these ocean dumps--and those near the dumping areas are being tested in relation to current flows, water samples, natural and unnatural environmental living conditions of the fish, levels of comparative change, physiology, and mortality rates.

All NMFS lab test results are being sent to FDA.

Much fishing industry money that once went for market promotion now goes for research. A voluntary inspection program, a sampling

of the finished fish product, is financed by the industry, mostly processors and shrimp manufacturers. Inspection stamps provide a reasonable degree of assurance to the consumer. Private firms are running spot checks, rechecking, and then monitoring regularly.

The traditional FDA market-basket survey now includes fishery products. NMFS says this is "just another step to protect the consumer."

This is still a crisis period, NMFS scientists caution. The swordfish industry has been virtually destroyed; the industry was made eligible in May for "product disaster assistance" from the Small Business Administration in the form of low-interest loans.

Tuna has fared much better. Only a few lots have been condemned. "There is no health hazard involved in eating tuna now held on retail shelves or in the household," NMFS scientists emphasize.

MERCURY

Mercury, a metallic element known too as quicksilver, is the only heavy metal that remains liquid at ordinary temperatures. Since the start of the Industrial Revolution, it has been used in everything from barometers to pesticides and fungicides. It is found in three forms: metallic mercury; inorganic mercury (mercury chlorides, sulphides and nitrates); and the organic mercury compounds (phenyl mercury acetates, phenyl mercury nitrates, methyl mercury and ethyl mercury). The last are the most toxic form.

In the biological chain, the two first forms convert into the methyl or ethyl mercury compounds, which are also very soluble. Normally, the effects of significant contamination by most mercury compounds are reversible, short lived, and excreted from the body over a period of time.

With methyl-ethyl mercury compounds, however, effects are not reversible. If the ingestion level is high, there can be irreversible damage to the brain and, possibly, death.

Mercury occurs in nature--in the sea, soil, and all natural foods. It has always been there. The important thing now is to try to lessen and prevent increased pollution of the environment.

Dr. Fred Stare, Chairman, Department of Nutrition, Harvard Medical School, has said: "There really are no safe or unsafe substances, only safe or unsafe levels, and safe and unsafe ways of using any substance. This requires a certain amount of common sense as well as scientific sense and the two are not always the same."

[Information for parts of this NMFS story is based on an interview with Dr. J. Perry Lane, supervisory research food technologist, NMFS Technology Laboratory in Gloucester, Mass., conducted by Wanda Howard, assistant editor, monthly publication of New England Marine Resources Program.]

NMFS PROTECTS MORE 'CONTINENTAL SHELF CREATURES'

The National Marine Fisheries Service (NMFS) acted in June to prohibit foreign vessels from taking 10 more species of marine animals it classified "creatures of the Continental Shelf." An amended regulation became effective when published in the 'Federal Register' on June 23.

These creatures are defined in the 1958 Geneva Convention on the Continental Shelf; at the harvestable stage, they "are immobile or are unable to move except in constant physical contact with the seabed or subsoil of the Continental Shelf." The U.S. is party to the Convention.

This Convention is implemented by a 1964 U.S. law, the "Bartlett Act". Under it the U.S. can reserve to its own nationals the right to harvest certain marine resources determined to be creatures of its Continental Shelf--except if an international agreement provides otherwise.

Additions to List

The animals added in June include: precious red corals and black coral; surf clams and ocean quahog; and these crustacea: Dungeness crab, deep-sea red crab, northern stone crab, golden king crab, and two species of California king crab (Paralithodes rathbune and Paralithodes californiensis).

Species previously listed included: tanner, king, and stone crabs; red and pink abalone; Japanese abalone; queen conch; and 4 kinds of sponges.

NMFS Director Philip M. Roedel said the list can be modified from time to time.

Dungeness Crab
(Cancer magister)

U.S.-SOVIET FISHERY SURVEY CONTINUES OFF U.S. WEST COAST

The 'Ogon,' of the Soviet Far Eastern Seas Fisheries Research Institute (TINRO), out of Vladivostok, docked in San Pedro, Calif., on June 30 to meet U.S. scientists and plan a 5-month series of cooperative survey cruises off the U.S. West Coast. This was disclosed June 23 in a joint announcement by Dr. D.L. Alverson, NMFS Biological Laboratory, Seattle, Wash., and Dr. A.R. Longhurst, Director, NMFS Fishery-Oceanography Center, La Jolla, Calif.

Moscow Meeting Nov. 1970

At a Moscow meeting in November 1970, attended by Drs. Alverson, Longhurst, and other U.S. fishery scientists, it was agreed: 1) Ogon would conduct a hydroacoustic survey and do biological sampling of Pacific hake population between 37° N and 50° N latitude; 2) also, a biological research program on ocean perch and feeding habit studies of hake and other fishes.

The Ogon displays a large sign, "NAUKA TINRO SSSR" (Science-TINRO-U.S.S.R.), to help identify her research status.

Interest in Hake Estimates

The NMFS laboratories in Seattle and La Jolla are interested particularly in estimates of hake abundance the Soviets will make using a hydroacoustic survey method, and in a plan to put U.S. scientists aboard vessel in July and August. The Soviets have agreed in principle that on all cruises designated for cooperative U.S.-USSR research, they would accommodate U.S. scientists.

The Ogon has worked off West Coast for the past two summers. It is part of a continuing research program on fish species of common interest. The program includes periodic meetings to exchange data and to review and plan research. In recent years, the Soviets fished hake heavily. Information is necessary to provide both nations with scientific bases for agreements to protect this resource.

The Ogon is captained by Alexander Bolshakov. It is a 190-foot, blue-gray, side trawler carrying 42 persons. It will work off west coast until November, then be replaced by a larger Soviet vessel.

NMFS WOODS HOLE AQUARIUM BEGINS SECOND DECADE

On June 12, the NMFS aquarium at its Woods Hole (Mass.) Biological Laboratory began its second decade of public service. During the first decade, $2\frac{1}{2}$ million persons saw the fish and educational exhibits.

The aquarium is open year round. It is visited by student groups of all levels: from headstart and preschool to college and postgraduate scholars. More than 40,000 youngsters have come in these groups, mostly in spring and fall. Some students have been helped with science projects and thesis requirements.

Cooperation With Scientists

The aquarium also serves marine scientists and aquarists. Many times, it has provided living material and tank space for experiments in physiology, animal behavior, and other fields. Aquarium staff has kept daily records of seawater and air temperatures for nearly 10 years. These helped investigators.

A water-quality monitoring project to begin soon will increase the aquarium's value to the NMFS Woods Hole lab and the scientific community.

NMFS MIAMI LAB RELEASES MORE DRIFT BOTTLES

Contributions by the Miller Brewing Co. of 40,000 bottles in the past 4 years to NMFS Tropical Atlantic Biological Laboratory (TABL, Miami) have helped oceanographers study the currents in the Caribbean and Gulf of Mexico.

During July and August 1971, oceanographers again will "pepper" the Gulf and Caribbean area with thousands of bottles from 8 U.S. and Mexican research vessels participating in the "Cooperative Investigations of the Caribbean and Adjacent Regions."

Bottled Information

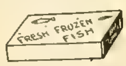
The bottles are ballasted with sand and contain a fluorescent orange card imprinted with a number and instructions in 4 languages. People who find the bottles washed up on beaches return them to TABL with information on time and locality of recovery. Returns have been received from nearly every country bordering the Caribbean, and from every state bordering the Gulf of Mexico and the U.S. South Atlantic coast. The oceanographers calculate the speeds and routes of currents from these widely scattered returns.

U.S. FISHERY PRODUCTS TO BE EXHIBITED AT COLOGNE FOOD FAIR

U.S. fishery products will be promoted at the world's largest food show in Cologne, Germany, Sept. 24-Oct. 1, 1971. The exhibition, attended primarily by food trade, is held every 2 years. U.S. fishery products have been promoted successfully since 1965.

In 1969, 46 nations sponsored exhibits. There were commercial exhibitions from 16 more countries. A total of 1,876 European exhibitors participated.

Germany is thriving and is an excellent market for U.S. foods. Consumption of frozen and convenience foods is growing rapidly as more housewives take jobs.



GULF & CARIBBEAN FISHERIES INST. MEETS NOV. 14-18 IN MIAMI

The annual meeting of the Gulf and Caribbean Fisheries Institute will be held at the Sheraton Four Ambassadors, 801 Bayshore Drive, Miami, Florida, Nov. 14-18, 1971.

Two sessions will be devoted to topics of specific interest to the fishing industry. Two sessions will emphasize current research in fisheries of Gulf of Mexico and Caribbean.

The International Game Fish Conference will hold its annual meeting Nov. 19 and 20.

For more information: Executive Secretary, Gulf & Caribbean Fisheries Institute, 10 Rickenbacker Causeway, Miami, Florida 33149.

COMMERCE DEPARTMENT BEGINS NEW STORM INFORMATION SERVICE

The Commerce Department's National Weather Service and National Bureau of Standards have established a new storm information service for deep-water sailors in the Atlantic and the Pacific. The service for the Atlantic is functioning; the Pacific operation is scheduled to begin August 1.

The new service consists of hourly broadcasts, up to 42 seconds each, providing information about major storms that might mean trouble for ships. The weather broadcasts are superimposed on Bureau of Standards time signals carried by stations WWV and WWVH.

Round the Clock

The broadcasts will be round the clock. Station WWV will carry information about storms in the western North Atlantic, 16 minutes after every hour, on radio frequencies 2.5, 5, 10, 15, 20 and 25 MegaHertz.

WWVH will list storms in the eastern and central North Pacific, 49 minutes after every hour, on 2.5, 5, 10, 15 and 20 MHz. The ocean areas covered are those for which the U.S. has warning responsibility under international agreements.

If there are no storm warnings in these areas, the broadcasts will indicate that. The brief messages will tell mariners if there are storm threats in their areas; they will not provide complete information. Mariners are expected to check with one of the regular marine broadcasts for details.

What Broadcast Covers

This is a hypothetical broadcast showing type of information mariners can expect to receive in the new service:

NORTH ATLANTIC WEATHER, WEST OF 35 DEGREES WEST, 1500 GMT. . .HURRICANE DONNA, INTENSIFYING, 24 NORTH, 60 WEST. . .MOVING NORTHWEST, 20 KNOTS. . .WINDS 75 KNOTS. . .TROPICAL STORM EVE, 17 NORTH, 50 WEST. . .MOVING EAST, 10 KNOTS. . . WINDS 50 KNOTS. . .STORM, 65 NORTH, 35 WEST. . .MOVING EAST, 10 KNOTS. . . WINDS 50 KNOTS. . . .SEAS, 15 FEET.

(Photo: Robert K. Brigham)

FISHERY PRODUCTS SITUATION

Donald R. Whitaker
NMFS Current Economic Analysis Division

The market for fishery products in the United States has maintained strength during the first half of 1971. Sales of some major species are slightly below year-earlier figures but, in the first half of 1971, this has been attributable primarily to shorter supplies. Conditions indicate a "seller's" market in most sectors. Prices have advanced sharply in face of tighter supplies of both shellfish and finfish.

Supplies of most shellfish are running below a year ago. Imports, as well as domestic landings, are down; declines in imports of shrimp have particularly affected the market. To meet market requirements in face of a drop in imports and domestic production, inventories of frozen shellfish have dropped sharply since the first of the year. Thus, the availability of stored supplies has made it possible for shellfish consumption to hold at nearly the same level as a year ago.

Groundfish Industry

Supply shortages have similarly affected the groundfish industry this year. The U.S. market for groundfish products is 83 percent supplied by imports. Imports are off from a year ago but, unlike shellfish, the groundfish industry did not have relatively large inventories on hand at the start of 1971. Thus, prices have advanced significantly, and groundfish sales are down from a year ago.

The shortage has had a particularly heavy impact on the fortunes of the "fish and chips" restaurant chains. The fast growth in the number of fish and chips outlets in the United States--from 500 or so in early 1969 to about 1,100 in early 1971--resulted in an unprecedented increase in demand for cod fillets. With supply shortages, prices began to skyrocket and adjustments in menu prices and portion sizes became necessary. The combination of short supplies and high prices may have temporarily halted the growth in fish and chips outlets. (See Canadian report page 9.)

Other Products

Halibut sales in the first half of 1971 have been consistent with last year. Prices changed little. Halibut production likely will be lower this year. Upward pressure on prices may build because of relatively lower supplies.

Canned salmon movements have been on a par with 1970. The 1971 pack will likely be below last year. So prices will gradually move up.

Frozen salmon sales have improved over a year ago, and prices have been firm. Inventories have dropped sharply since the first of the year but are still above normal.

Canned tuna movement has picked up considerably since the early months of 1971. Prices are expected to average higher than a year ago.

On balance, a slight decline in per-capita fish consumption in expected in 1971 after 3 consecutive years of increase. The major factors behind the decline will be higher prices accompanied by shorter supplies.

THE U.S. FOOD MARKET

How Trends Affect Outlook for Canadian Groundfish Products

There are important trends in the U.S. food market that affect the "future profitability and export opportunities of Canadian producers of groundfish products."[1] A new Canadian report evaluates these trends and opportunities.

It was prepared in the Agriculture, Fisheries, and Food Products Branch, Department of Industry, Trade and Commerce, by G. W. Raynes under the supervision of A. J. Hemming. It is titled: "Developments in the United States Food Market and Their Significance for Canadian Groundfish Products." The sponsors hope it will help Canadian industry adjust to the changing structure of U.S. market.

The report discusses the traditional retail sector--but focuses on the booming food-service market, particularly the dynamic fish-and-chip industry. After only 5 years, this industry exerts a "significant influence on the demand for cod."

The Canadian investigation of trends in the U.S. food market and their implications for groundfish products is based largely on 132 interviews in major geographic regions in 1970.

The investigation was directed toward major retail food chains, food-service operators, and the fish-and-chip franchises in particular. For the Canadian processing industry, these are primary sources of present and future demand for groundfish products.

The 34 retail chains surveyed operated 19,000 stores and accounted for over 35% of U.S. retail food sales. Eleven of the 12 leading chains were included. Dominant firms in major sectors of the expanding food-service market were surveyed; in fish-and-chip sector the companies interviewed accounted for an estimated 75% of the industry's total sales.

[1] Among major groundfish species are cod, haddock, flounder.--Ed.

THE UNITED STATES FOOD MARKET

Trends in Food Consumption

The proportion of the per-capita disposable income U.S. spent on food is declining steadily, but the absolute level of food spending continues to grow as population and disposable income grow. Between 1950 and 1968, U.S. population increased at annual rate of about 1.7%; disposable income expanded 185% to $590 billion. These trends more than offset a 23% decline in the proportion of per-capita disposable income spent on food; total consumer spending on food and beverages increased 116%. In recent years, spending for food and beverages has been increasing about 5% a year.

Relative Importance of Food-Service Industry

Retail food stores are selling about $62 billion of food, excluding beverages. The comparable figure for food-service[2] sector is about $28 billion per year. The latter, however, is expanding more rapidly. Between 1960 and 1966, the average growth rate in food-service sales was about 10% per annum. By 1977, it is estimated, food sales by food-service industry will be about $50 billion compared with $87 billion in sales by retail sector. By 1980, the food-service market could achieve over 60% of all food sold in U.S.

There is a growing trend in the U.S. to "eat out." Many factors are responsible, including especially:

(a) Higher disposable incomes and raising of median income. In 1967, the median family income was $7,974, compared with $4,611 in 1950. By 1980, 50% of U.S. households are expected to have incomes of at least $10,000 per year and account for 75% of personal income.

(b) More women are working. By 1980, their number will have increased by 4 million to about 20 million.

[2] Food-service sector included 370,000 establishments in 1966: table-service restaurants, cafeterias, counter service, drive-ins, drug and retail stores, etc.

Almost one of every three dollars spent on food in the U.S. is spent on food eaten outside the home.

More Demand for Convenience Foods

There has been a significant shift toward convenience foods. These are products ready to serve, or require only secondary heating or other preparation. Estimates are that retail sales of convenience foods alone reach $36 billion a year. This places them in a dominant position in U.S. market. Sales of foods with built-in convenience are growing substantially faster than basic commodities. The trend favors heat-and-serve convenience foods in retail and food-service sectors, particularly in the latter.

The Frozen Food Market

Frozen food is the category most affected by boom in demand for convenience foods. It has been growing fastest. Between 1960 and 1968, the retail value of frozen food sales increased 115%; total food sales, up 28%. More significant, there are important shifts in relative importance of frozen-food categories and in food-service sales relative to retail.

Demand is shifting from relatively basic commodities to products with greater convenience. In 1967, per-capita spending on frozen foods increased just over 2%; spending on prepared foods rose almost 9%. This rate of per-capita increase exceeded greatly all frozen-food categories, except meats. Within the product class, frozen dinners attracted highest per-capita expenditures and grew faster than any other prepared food.

The food-service frozen-food market is growing in importance. In 1967, per-capita spending on food-service frozen foods increased over 4%, compared with under 1% for retail frozen foods. The food-service share of current annual market for frozen foods is $2.6 billion, compared with $7 billion in retail sector. Annual food-service sales of frozen prepared foods, such as entrées, are now $249 million.

The minimum percentage growth in sales of prepared foods between 1968 and 1980 should be 84%; for all frozen foods, a 67% rate of growth is projected. Prepared foods are the major category of frozen foods. In 1968, sales were $1.14 billion; projected minimum sales of $2.37 billion in 1980 would retain this position.

The motivation for industry's increasing orientation to frozen convenience foods comes primarily from need to minimize labor costs and from problems connected with unskilled kitchen help. Industry views these as major problems. For the housewife today, the decision to buy convenience foods is largely a matter of preference and tastes; for food-service operators, the use of convenience foods is dollars and cents, the need to remain competitive.

The shift to convenience foods is more rapid in food-service sector than at retail level. In the home, any additional cost is not connected so closely with labor saving as for the food-service industry, where time saves money. Convenience foods offer other advantage to food-service operators: "they can provide the basis for expanded menus, improved cost and quality control, lower inventories, savings in space, reduced cooking time, more rapid service, and the efficient use of unskilled labor."

The Frozen Seafood Market

The trends in the food market apply with at least equal force to the seafood market. More than half the seafood marketed is now sold frozen; the conservative demand projection indicates sales of frozen seafoods should expand by at least 107% between 1968 and 1980. Frozen convenience foods range from ready-to-serve seafood dinners, entrées and other precooked items to frozen portions and fillets, where major growth potential is concentrated. Between 1968 and 1969, estimated retail and food service sales, in pounds, of fish sticks rose by 24% and 20% respectively, while fillets expanded by 16% and 17%. Both retail and food-service sales of fish portions expanded by 21% in 1969. This contrasted sharply with trend between 1960 and 1968, when average annual growth in frozen seafood in dollar terms was minus 0.3%.

Whereas the United States retail sector is the major source of demand for food as well as for frozen foods in total, the food-service sector is already the major source of demand for frozen seafoods. In 1969, total food-service sales of frozen seafood--excluding seafood specialties or bulk fish shipped and sold fresh by dealers--were over $862 million, compared with retail sales of $464 million.

Food-service sales of specialty seafoods are now 48 million pounds a year; sales of entrées, which include seafood items, are about 50 million pounds.

The demand for frozen groundfish products is more evenly divided between retail and food service. Combined sales of fish portions, sticks, and fillets total estimated $140.3 million in food-service sector and $197.8 million in retail sector.

The Market for Groundfish Products

Like the market for frozen foods generally, the U.S. market for frozen seafoods, including groundfish products, is growing dynamically in area of convenience products. This is attributed to combined stimulus of changes in consumer attitudes and incomes, new markets in food-service sphere, and more emphasis on innovation by processors in this age of convenience foods.

While retail food chains foresee expansion in demand for frozen groundfish products, and in breaded-and-battered items in particular at retail level, the food-service industry, especially the fast-food fish-and-chip franchises, will be the major source of future growth. This was confirmed by wholesalers and other distributive organizations: Some now concentrate on catering to requirements of food-service users of frozen fish; and also by the projected expansionary plans of the fish-and-chip franchises.

This optimistic view of future demand for maximum-convenience frozen groundfish products contrasts markedly with attitude of the great majority of retail food chains toward fresh fish. Although 80% of retail chains interviewed operated fresh-fish departments, these were not expected to grow rapidly because consumers, more and more, prefer frozen fishery products. Some fresh-fish departments are now unprofitable because of rising labor costs but are operated as convenience to buying public. One reason the fresh-fish department lacks growth potential is that it has remained outside mainstream of product innovation.

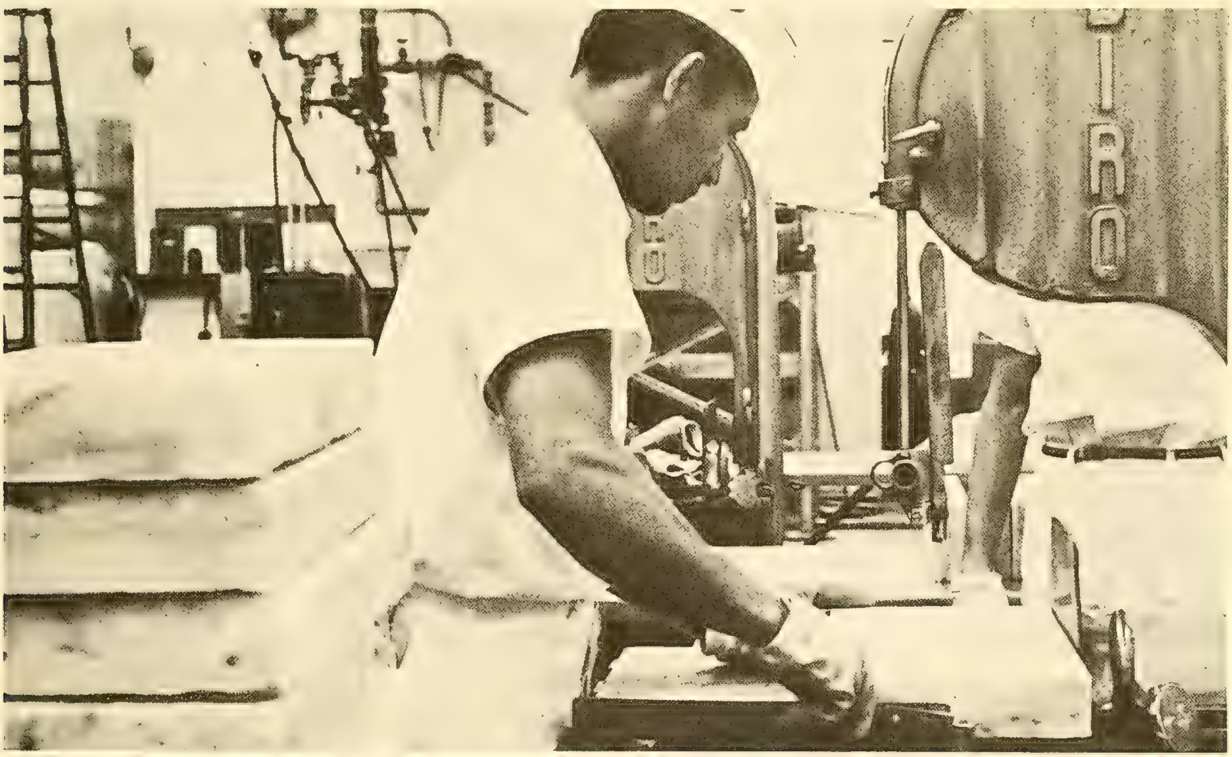


Fig. 1 - Production of Breaded Fish Portions. A series of cuts with high-speed saws turns blocks into uniform portions desired.

THE RETAIL FOOD MARKET

Frozen Foods

Frozen foods are the food category most affected by upsurge in demand for convenience foods. They have the greatest relevance for groundfish products. They now account for 5.2% of total food sales of U.S. supermarkets. It is estimated that this percentage will rise to 7% by 1975, and to 8.3% by 1980. A major impediment to growth of frozen foods at retail is lack of display space, together with insufficient zero-degree space in company warehouses.

Freezer space inhibits sale of fish products. The freezer space allocated to fish by First National Supermarkets ranges from 4 feet 2 inches by 7 feet, depending on total freezer capacity of the individual stores. The proportion of total space for fish products is 7%; fruit 3%; frozen meats 4%; potatoes 7%; dinners and meat pies 11%; concentrates 12%; bakery products 16%; frozen vegetables 27%.

The freezer space in new and remodelled stores is being expanded substantially, up to three times the old system.

Convenience Products

The retail food chains and other buyers have connected expanding demand for frozen groundfish products with the availability of convenience-type products. Nearly all supermarket buyers interviewed believe convenience foods will be the future growth center in retail frozen foods. Supporting this growth are: the continued introduction of new prepared, frozen-food products, more working women, and increasing income of U.S. consumers. The eventual introduction of rapid-heating equipment, such as microwave ovens in the home, will make it still easier to use convenience foods.

Introduction of New Products

About 18% of retail frozen-food sales did not exist or were of minor importance in 1965; this figure will be near 35% by 1980. One major supermarket chain introduced 26 new seafood products in 1970; consumers were extremely receptive. By 1980, the average supermarket will handle about 800 frozen food items, compared with 375 to 450 now. Also, there is a growing market for premium-quality frozen foods.

Growth Potential for Groundfish Products

Precooked breaded-and-battered items, especially portions, and dinners and entrées, hold the greatest potential for groundfish products. Retail sales of these products, with some exceptions, were "buoyant". New precooked convenience items with much consumer appeal are largely responsible for sales growth. They are of primary importance to future of seafoods in U.S. market.

Fig. 2 - Fish Portions.

Quality

There were no negative comments on quality of convenience seafood products as such, except for some on batter content. This contrasted sharply with situation in late 1950s, when low quality checked growth in demand for fish sticks.

Frozen Diet Dinners

Frozen diet dinners, unsuccessful when introduced in 1950s, now are popular. This resulted from greater concern among U.S. consumers about coronary diseases and publicity about fish's nutritional advantages. These dinners use such groundfish species as haddock, flounder, and cod.

Seasonal Fluctuations in Seafood Sales

The 6-week Lenten season remains the peak selling period for seafoods. On national basis, however, sales now are much more evenly distributed over the year. Combined Lenten sales of seafoods in 7 major markets have been about 10% of annual sales; monthly sales during rest of year ranged between 6.7% and 8%. There were secondary peaks during Thanksgiving and Christmas periods. Supermarket chains have spread their seafood promotion over the year to coincide with these trends.

However, within the U.S. pattern, monthly distribution varies markedly from market to market. In 1969, for instance, sales in Detroit, Mich., peaked during Christmas season; in Atlanta, Ga., annual sales were lowest then.

Supermarket sales used to peak on Fridays; now they are more evenly distributed throughout week.

Distribution of Seafood Products

Except for private label, the supermarkets do not carry anywhere near a full line of a seafood brand. No brand, except Mrs. Paul's, is distributed nationally. The chains with private labels tend to view other brands as complementary to theirs.

Impact of Food Service Sector

The retail sector is more concerned at the growing diversion of potential retail food sales to food-service industry, especially to fast-food sector. Take-out sales now total almost $1.5 billion a year. To supermarkets, take-out sales in particular are purchases that traditionally would have been theirs.

As consumption of foods prepared away from the home grows, the supermarket chains are acting to get their share:

1. Some have established food-service divisions. The chains already have warehouses and delivery facilities and can offer one-stop distribution.

2. They offer hot, ready-to-serve, take-out foods. About 60% of supermarkets open last year had these sections. However, this trend is still in its infancy.

If the present trend continues, delicatessens will be the focus of supermarket expansion in take-out foods.

3. Competing directly with fast-food operators. Several supermarket chains have specialty restaurants.

Product Specifications

An important segment of buyers, the largest retail buyers, insists that processed groundfish products meet rigorous specifications, including packaging. All retail buyers place importance on high quality, at least equal to national brands, the advertising and promotion, and the reputation and consumer appeal of the brand. It is expected that product will meet usual standards on absence of bones and be covered by liability insurance.

A new product normally is tested. There are wide variations in thoroughness of testing procedures. The general tendency is for large retail buyers to test product thoroughly and for medium-sized chains to rely on brand reputation.

Criticism of Canadian Groundfish

Criticism by retail buyers of Canadian groundfish was not significant statistically. It was confined to bones and texture. The Canadian product was compared unfavorably to Icelandic commodity. On eastern seaboard, buyers for retail chains assume that products are boneless to a degree acceptable to the consumer. They merely require seller to have liability insurance to cover claims arising from sale of products containing bones. In western states, buyers expect products to be completely free of bones.

Purchasing Practices

Chains make little use of wholesale distributors. The major method of buying the frozen product is direct buying--from processors or through their broker representatives.

Merchandising

Eighteen retail outlets were inspected for merchandising of seafoods. No clear pattern emerged. In freezer space and in-store merchandising, the promotion of seafood could not

be rated "completely inadequate," simply dull. Generally, management still considers frozen seafoods low-interest items.

The expansion of retail demand for frozen groundfish products will depend heavily on product innovation.

Private Label

Over half the retail food chains had their own label in certain seafood items. While it was found that chains of similar size had differing philosophies on private labelling, there is a functional relationship between the size of the chain and the use of private label by major retail food organizations. Some 75% of chains with over 90 retail outlets carried their own private label; only 36% of smaller chains. When members of Topco Associates, a major group buying organization, are excluded, the latter percentage falls to 14%.

Selling Performance of Canadian Producers

Excluding the three largest chains, no major retailers stated that Canadian or other foreign producers of groundfish products had established direct and significant relationships with them. And none was critical of this.

Canadian processors of groundfish products concentrate sales function in the hands of brokers. This is how Iceland and other producers supply retail food market. The selling performance of Canadian producers is as good as their foreign competitors'.

As demand turns more to sophisticated processed products, volume sales are concentrating in hands of large food brokers, especially those who service food-service sector. These firms have specialized selling techniques necessary for high sales performance. So large brokers are becoming the major selling channel for Canadian processors. The small traditional brokers may be reduced to a marginal role.

THE FOOD SERVICE MARKET

Scope of Market

The food-service market, in 1966, had over 370,000 establishments: table service restaurants, cafeterias, counter service, drive-ins, drug and retail stores; industrial, hotel, motel, recreational and amusement places for eating; hospitals, nursing homes, schools, colleges, universities, and military establishments.

Public eating places account for about two-thirds the total retail value of food sold by food-service industry. Sixty percent of these places are separate establishments; the remainder are part of other businesses--variety stores, hotels, motels. Nonpublic eating places account for about one-third the retail value of food sold by food-service industry: schools, hospitals, and homes for children, the aged and the mentally ill.

Fast-food service offers some convenience in eating. It accounts for 80% of U.S. food-service business; the value of annual food sales by service restaurants is only 20%. Service restaurants provide table service in a dining room, have extensive kitchen facilities, a professional chef, and offer full courses.

The food-service industry is growing about twice as fast as the retail food sector. The industry is substituting capital for labor, and production-line labor for skilled labor.

Average sales per employe in food-service sector is $8,500; they are about $18,000 for supermarket employe, and $22,000 in average retail outlet. Wages are rising at 2.3% annual rate, considerably above growth in productivity. The upward trend in wages in the food-service industry is accelerating.

The evidence points to steadily increasing use of convenience foods, particularly frozen form. In long run, this probably will be produced in commercial processing plants instead of commissaries.

Demand for Seafood

The consumption of seafood, excluding seafood specialties, by food-service sector is estimated at 680 million pounds a year; of these, 250 million pounds are used by restaurants, 115 million pounds by school-feeding sector.

Frozen groundfish sticks, portions, fillets, entrees and other convenience products of the heat-and-serve variety are gaining increasing acceptance among food-service operators. However, the major growth in volume is concentrated (except for fish sticks) in uncooked breaded portions and fillets.

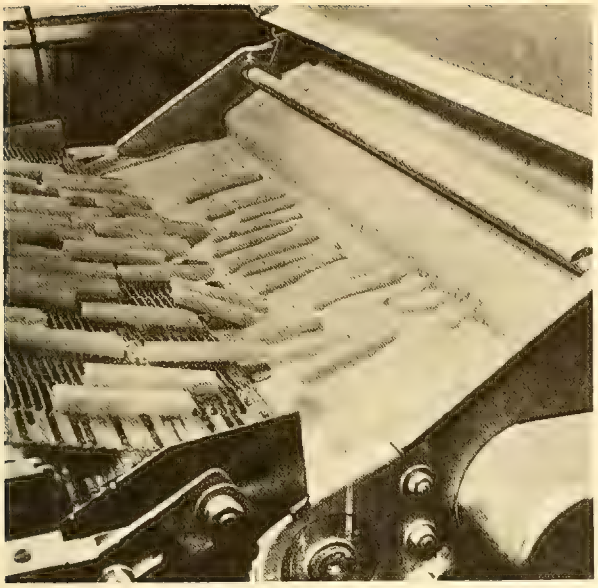


Fig. 3 - Fish sticks passing from batter to breading.

At present, the primary growth area for groundfish products is the fast-food sector of the industry: drive-in and take-out restaurants. The fish-and-chip sector of this industry uses only frozen fillets and uncooked unbreaded portions; other fast-food operators, much less oriented toward use of fish, primarily use breaded or battered portions, generally uncooked.

There has been growing demand for fish portions, now 15 times that for fish sticks in food-service sector. Major reasons are: popularity of fish sandwich, introduced in 1964; portions permit precise serving and cost control. The rise in U.S. consumption of fish portions closely parallels growth of drive-in restaurants.

The large chains in this category, McDonalds and Burger Chef, use substantial amounts of fish portions: each about 10 million pounds a year.

The demand for groundfish fillets and portions developed spectacularly with growth of fish-and-chip franchises in U.S. The story began in 1965, when Haddon Salt established his first outlet at Sausalito, near San Francisco. By the end of 1970, the industry had an estimated 1,150 outlets use groundfish at annual rate of 54 million pounds. Industry consumption in 1970 is estimated at 46 million pounds.

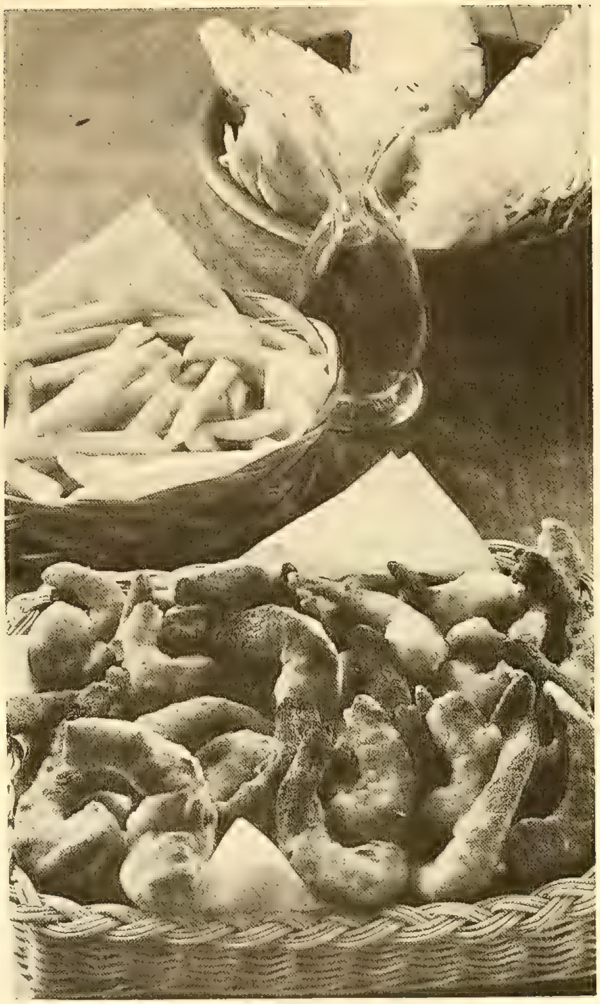


Fig. 4 - Broiled Breaded Shrimp.

The Fish-and-Chip Industry

Like other sections of the U.S. fast-food industry, the fish-and-chip firms are franchise operations. The franchise concept permits companies with limited capital to expand rapidly.

There is a trend toward company ownership of units because this offers the prospect of much greater net returns than royalties from independent franchise operations.

The largest concentration of fish-and-chip outlets is in the western United States; the lowest in the midwest.

The companies cater to sit-down and take-out trade.

Raw Material

The species of fish used almost everywhere by the fish-and-chip industry is cod, primarily because it is relatively low cost.

The Coldwater Seafood Corp. is the dominant supplier of cod to the industry because of the high quality of the Icelandic product and its "aggressive development of this market from its inception."

No firms were located within the fish-and-chip industry that knowingly use cod from Canada. The companies reported that Canadian suppliers had no interest in servicing the industry.

The feeling within the trade is that Canadian cod is inferior to Icelandic and Norwegian cod. Burger Chef, with over 1,000 outlets and annual use of over 10 million pounds of cod portions annually, will not knowingly buy Canadian cod.

"The defects cited range from the presence of parasites, pinbones, skin, black spots, belly-flaps and napes in fillets and blocks, to soft texture and unsatisfactory flavour."

The great majority of companies interviewed did not have first-hand experience with Canadian cod.

The Icelandic block of fillets is smooth. The Norwegian product contains fillets out of shape and difficult to portion. This impedes development of an efficient in-store portioning technique.

The industry believes Iceland can supply all requirements for the foreseeable future. The smaller companies have tended to accept this assurance at face value. Three major companies are very concerned about the future availability of cod; two of them have attempted to find more sources of supply. The industry is more receptive to the prospect of using Canadian cod--providing minimum specifications can be met.

It is estimated that by 1975 the annual raw material requirements of the industry will be 155 million pounds, over 3 times the estimated level of demand in 1970.

It is estimated that there will be 3,250 fish-and-chip outlets in the U.S. by 1975.

The fast-food industry, the major user of groundfish in the food-service sector, has been largely neglected by Canadian processors.

SURVEY FINDINGS AND RECOMMENDATIONS FOR ACTION

(1) Demand

The food-service sector will be the focal point of long-run growth in demand in U.S. food market. Convenience foods will be product group with greatest growth potential. "This conclusion is also applicable to the long-run demand for groundfish products."

The important factors in U.S. demand for groundfish products are:

(a) The fresh-fish market is relatively static. Growth in demand for groundfish products is concentrated in frozen-food sector.

(b) Retail and food-service demand for frozen groundfish is expanding, but growth potential is much greater in latter area. This results from growth of institutional catering and fast-food franchises based on the sale of battered-and-breaded fish products.

(c) The products in growing demand are primarily those with high degree of convenience and product innovation. More consumers like them and they meet specialized requirements of food-service buyers. The major exception to the rapidly growing demand for precooked breaded-and-battered groundfish products is the fast-food industry. But even this sector requires the convenience of precut portions, breaded or raw, as well as standardized fillets.

Another convenience food, fish sticks, is experiencing a slower growth rate than portions. But it is second only to portions as groundfish product in greatest demand in dollar and volume terms on U.S. market. U.S. production of portions and fish sticks, based on supply of foreign raw material, rose from

60,061 tons and 69,903 tons in 1960 to 216,453 tons and 113,338 tons in 1969. Portions, stimulated by expansion in food-service demand, showed uninterrupted annual growth.

U.S. imports of fish sticks and portions from Canadian sources have been insignificant in terms of total market demand. The situation resulted primarily from tariff barriers. It may now be opportune for Canadians to examine thoroughly "the economic feasibility of greater processing of convenience groundfish products for sale in the U.S. market."

The bulk of the demand in the future may be for completely bone-free fish. This and demand for premium products suggest that Canadian producers should up-grade their standards.

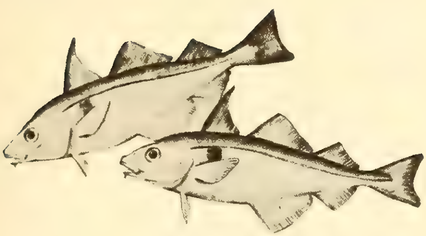
Product Innovation

Improved quality and product innovation to meet buyer desires for more convenience in food products are the "prerequisites for the expansion and maximization of the market share of the Canadian groundfish industry in the U.S. market."

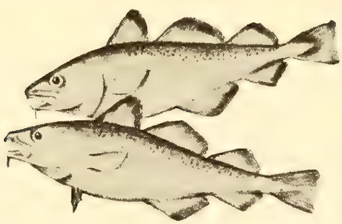
"The available statistical evidence suggests that the market importance of many high-value seafood products, such as flounder, sole and halibut, in their predominant retail forms can be expected to decline within the next decade. This long run trend can be expected to continue unless new and more popular products are developed, particularly frozen, highly processed convenience items."

In the U.S., most of the companies that were engaged directly in the supply of fresh fish 20 years ago have gone out of business. Firms that relied on the markets for frozen fish and/or fillets have had trouble remaining solvent. But specialty companies that have used the basic raw material to produce the precooked fishery products have thrived. The largest seafood processors are product manufacturers rather than packers of commodities. "Such growth as the U.S. fishery industry has achieved over the past 20 years is directly attributable to the introduction of convenience type products."

Flounder



Haddock



Cod

OCEANOGRAPHY

INTERNATIONAL STUDY OF CARIBBEAN CURRENTS IN JULY & AUGUST

The 3-year, 15-nation oceanographic investigation of the Caribbean and Gulf of Mexico has a new phase scheduled for July and August. U.S. scientists and ships are participating. Its main objective is an intensive study of the circulation patterns to determine which processes cause them. The U.S. efforts, mainly by NOAA, will concentrate in the western Caribbean, Yucatan Channel, and southeastern Gulf of Mexico.

Trade Winds & Ocean Currents

Scientists think the trade winds over the tropical Atlantic and Caribbean are the prime movers of the ocean currents in the Caribbean, Gulf of Mexico, and the Florida Straits. It is unclear, however, how this input of wind momentum is organized into an ocean current. One assumption is that the input first drives a series of eddies which, in turn, drives the larger-scale currents. An older hypothesis is that the western Caribbean currents are driven directly by the winds to flow uphill against gravity. And there are other assumptions.

The Operation

"The extent and nature of the ocean currents will be determined by radar tracking of radio-equipped parachute drogues deployed 120 feet below the surface. The temperature, salt content, and depth of the water also will be measured, plotted, and studied and examinations made of the distribution of certain trace metals. The deep-water tides will be studied by current meters moored close to the ocean bottom. And the temperature, speed, direction, and humidity of air currents and the nature of clouds will also be investigated to provide background for an understanding of the interaction between the sea and the atmosphere."

Dr. Harris B. Stewart Jr., of NOAA's Atlantic Oceanographic and Meteorological Laboratories in Miami, Fla., is U.S. National Coordinator for the project, known officially as the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR). He said that in previous efforts little more than one-ship scientific work had been done.

"The Caribbean Sea with its adjacent Gulf of Mexico is, oceanographically speaking, still poorly described and even less well understood," he stated. "Now, its dynamics, its contained life, its bottom topography and tectonic framework, its interactions with the overlying atmosphere, and the dynamics of the atmosphere above it are the subjects of a cooperative international investigation sponsored by the Intergovernmental Oceanographic Commission."

International Study

The August study of circulation will include ships from Colombia, Cuba, Mexico, the United Kingdom, Venezuela; NOAA's National Ocean Survey and the National Marine Fisheries Service; and from the U.S. Coast Guard.

About 15 NOAA scientists will work aboard two floating oceanographic laboratories of the National Ocean Survey, the 'Discoverer' and 'Researcher'.

CLAMS: Resources Are Healthy, Says J. P. Wise

[The April 1971 Commercial Fisheries Review (CFR) included: "Ocean Quahog Becomes More Important As Surf & Bay Clams Dwindle." The article was based on information from the New England Marine Resources Program. The program is supported by the Sea Grant College and Program Act, the State Technical Services Act and the University of Rhode Island. . . Ed.]

John P. Wise, NMFS Tropical Atlantic Biological Laboratory, Miami, disagrees with the statement that clam resources are dwindling. He writes: ". . . this is in fact not the case. I have enclosed some tables and graphs on surf clams, hard clams, and soft-shell clams, extracted from official NMFS statistics, that seem to show that the fisheries are in healthy shape with <u>increasing</u> catches over the last several years. (The apparent decline in hard clam catches in the early 1950's was caused by a temporary upsurge in landings in the late 1940's and early 1950's.)

"A minor point is that <u>Spisula</u> <u>soldissima</u> is almost universally known as 'surf clam' not 'sea clam'."

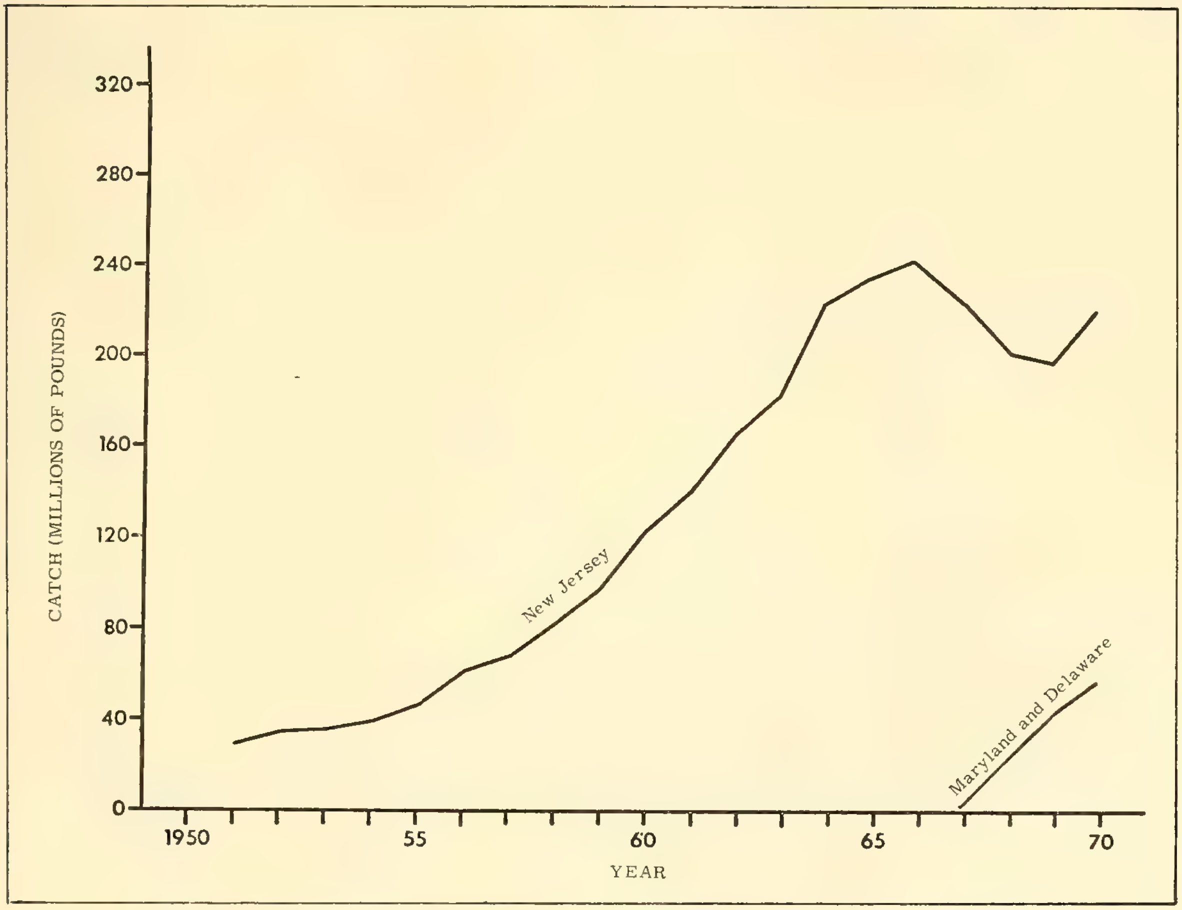


Fig. 28A.1 - Surf clam catches in certain states, 1951-70 (smoothed by moving average of 3).

Table 28A.1 - Catch of surf clams landed in various states, 1945-70

Year	New York	New Jersey	Delaware	Maryland
	----------- millions of pounds (whole) -----------			
1945	18.7	2.8	-	-
1946	30.5	-	-	-
1947	14.8	.9	-	-
1948	16.9	.9	-	-
1949	23.1	2.2	-	-
1950	15.5	22.8	-	.5
1951	19.0	33.9	-	-
1952	19.5	94.0	-	8.5
1953	15.7	36.4	-	10.0
1954	15.8	36.4	-	5.5
1955	9.5	43.8	-	6.9
1956	11.1	61.3	∅	7.6
1957	7.5	80.6	.2	3.8
1958	2.0	66.0	.8	3.2
1959	2.4	106.7	1.7	3.5
1960	3.4	124.1	.5	1.7
1961	3.4	141.3	-	.3
1962	3.9	157.9	.4	.3
1963	4.6	199.8	-	.3
1964	5.7	195.2	-	.2
1965	7.0	224.0	-	1.1
1966	8.7	228.6	-	∅
1967	10.8	220.1	-	.1
1968	14.2	170.4	-	21.8
1969	16.1	190.8	11.3	29.2
1970	18.3	209.6	12.3	56.1

Conversion factors (meats to whole): New York 4.706
New Jersey 5.294
Maryland 4.092
Delaware 4.092
∅ less than .05 million

Table 28B.1 - Catch of various clams, 1950-69

Year	Hard clam	Soft clam	Razor clam	Ocean quahog	Other
	----------- millions of pounds (whole) -----------				
1950	177.9	42.7	5.9	1.8	.6
1951	175.9	41.1	6.5	1.6	.3
1952	148.6	33.4	4.1	3.9	.2
1953	143.5	25.8	4.5	2.2	∅
1954	114.3	23.3	3.8	1.6	.5
1955	125.4	23.3	5.7	3.6	.1
1956	124.2	27.8	2.3	3.1	.2
1957	124.8	26.0	2.4	3.1	.1
1958	120.7	30.0	1.8	2.1	.1
1959	114.6	32.5	2.3	.8	.1
1960	125.8	39.0	1.9	1.5	.2
1961	123.5	33.5	1.7	1.0	.1
1962	112.4	42.8	1.2	.5	.1
1963	122.8	44.4	1.0	.8	.1
1964	126.2	50.2	.6	.9	.1
1965	127.2	51.5	.7	.7	∅
1966	129.5	54.2	.6	.7	.3
1967	136.8	44.7	.7	.4	.5
1968	130.4	47.2	.5	1.8	2.3
1969	137.2	61.3	.6	5.1	3.4

Conversion factors (meats to whole): Hard clam 8.454
Soft clam 4.551
Razor clam 2.334
Ocean quahog 8.000
Other clams 5.000
∅ less than .05 million pounds

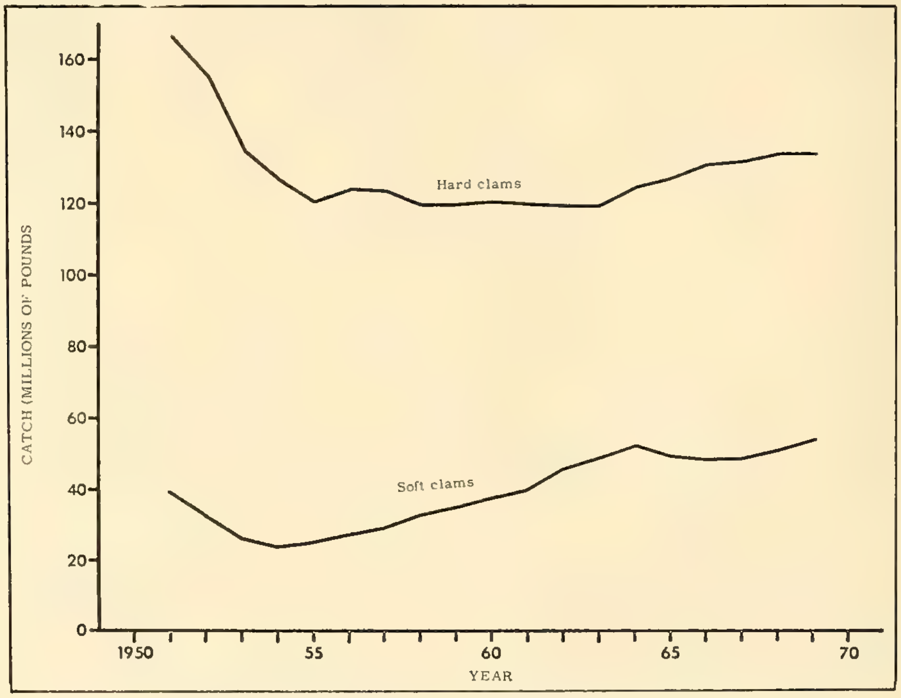


Fig. 28B.1 - Hard and soft clam catches, 1951-69 (smoothed by moving average of 3).

DISTRIBUTION OF SOME COASTAL PELAGIC FISHES IN THE WESTERN ATLANTIC

Edward F. Klima

The coastal pelagic resource of the Gulf of Mexico and South Atlantic is presently underutilized--mainly because it occurs in many small, fast-traveling schools that cannot be harvested by conventional fishing. The Pascagoula Exploratory Fishing and Gear Research Base has been developing harvesting systems for this vast resource (Klima, 1970). This paper summarizes the scant information available on its distribution and abundance.

I have used the exploratory catch data collected since 1950 by the Pascagoula Fishery Center to provide some idea of the magnitude and distribution of the coastal pelagic resource in the Gulf of Mexico and western Atlantic. The Atlantic, including the Gulf of Mexico and Caribbean Sea, is subdivided into 27 exploratory fishing zones (Figure 1). Unfortunately, sufficient data are not available to describe seasonal distribution within any one year, so the catch data for 1950 to 1969 were combined by season within subareas. Variation within a year was assumed to be unimportant in terms of seasonal distribution trends. To describe roughly the seasonal depth-distribution trends, the records of all exploratory fishing with gill nets and bottom, shrimp, and midwater trawls were combined.

Quantitative data are not available for the species discussed, and each fishing record represents a valid identification. Grouping these data, however, is assumed as an index of the relative availability of a species. In addition, commercial landing statistics provided additional distributional data for Spanish sardine, thread herring, and round scad.

COASTAL PELAGIC FISHES

A preliminary acoustical survey of the coastal schooling fishes from North Carolina to Florida was conducted in 1968. Selected data (Drummond, MS) provide an overall picture of the seasonal north-south distribution of the midwater schooling fishes from Cape Hatteras to Cape Kennedy. Figures 2, 3, and 4 show the north-south distribution for March, July, and November. In the spring, midwater schools are most commonly located between St. Simons Island, Georgia, and St. Augustine, Florida (transects 17 to 21), and from south of Jacksonville to south of Cape Kennedy (transects 24 and 25). Generally, few schools occurred north of St. Simons Island.

Summer and Fall

During the summer, midwater schools were found throughout the entire survey area but with much greater frequency in the southern portion. Fish schools were most common off South Carolina; St. Simons Island, Georgia; Mayport and St. Augustine, Florida. There seems to be a slight shift northward in school concentrations from spring to summer. In the fall, there is less frequency of schools in the extreme northern portion from Cape Hatteras southward to Georgia; there is a significant increase in frequency in the central portion off St. Simons Island, Georgia, and a slight increase southward from New Smyrna to Fort Pierce, Florida. Apparently, there is a southward shift in the population during the fall; a definite aggregation of its major portion is off St. Simons Island, Georgia, and central Florida.

SCALED SARDINE
(Harengula pensacolae)

This species is widely distributed from Florida southward to Brazil, including the Gulf of Mexico. It is a near-surface, schooling, plankton feeder along coasts, but it is sometimes found several miles offshore. Exploratory records indicate that this fish is usually found within the 20-fathom curve but, on occasion, it has been seen as far offshore as the 165-fathom curve in the northern Gulf of Mexico (Figure 5) and the 257-fathom curve

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COMMERCIAL FISHERIES REVIEW
Reprint No. 911

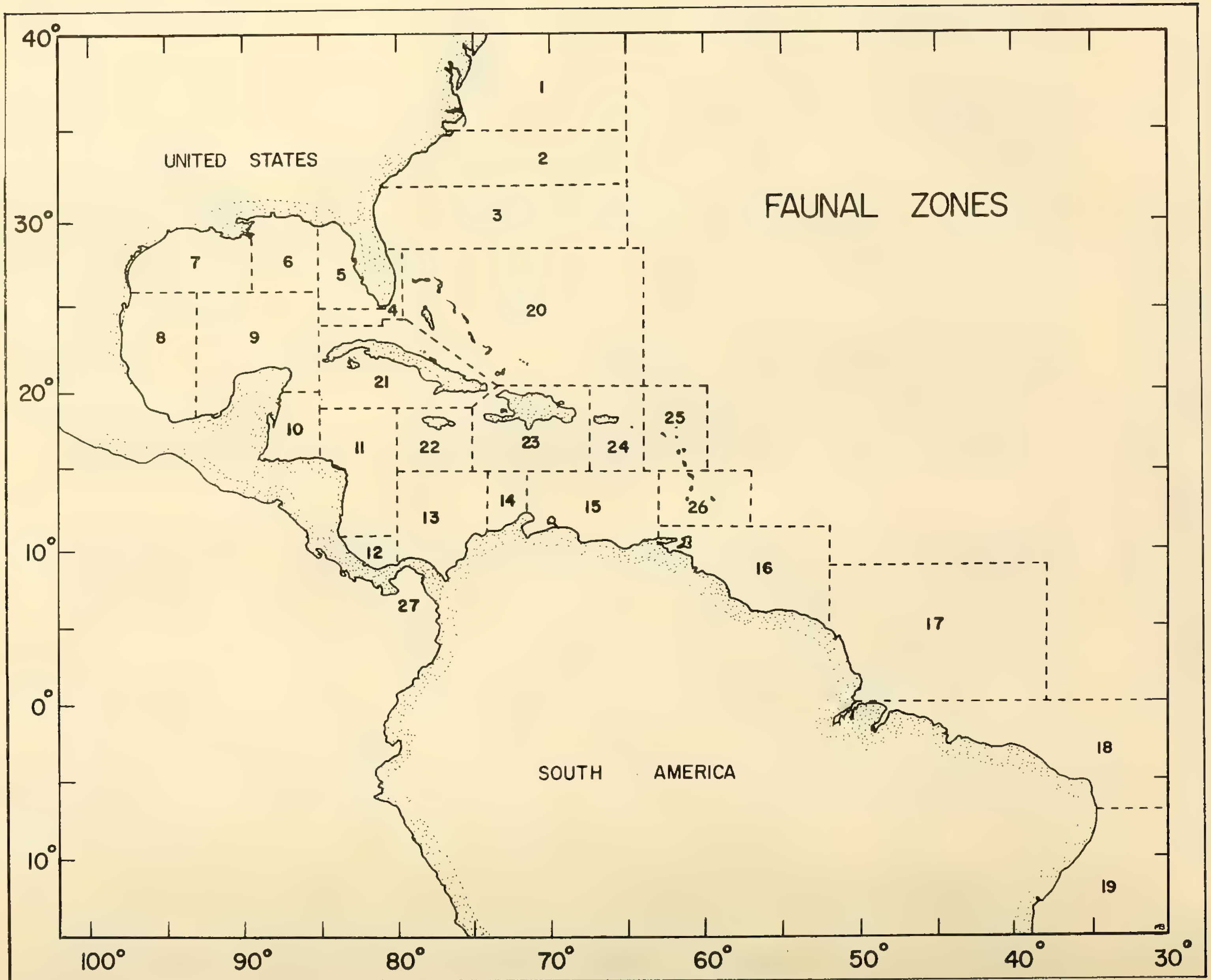

Fig. 1 - Exploratory fishing faunal zones.

off Colombia. It may be found with H. humeralis and H. clupeola in the Florida Keys and along the north coast of Yucatan, but it is the only species of Harengula inhabiting the Gulf Coast of the United States.

Scaled sardines are not exploited in the Gulf of Mexico, although they are harvested off the coast of Venezuela (personal communication, Rivas), where they are caught with beach seines and canned for local consumption. In Miami, Florida, they are caught with lift nets around piers and bridges in the fall and winter and sold as live bait (Klima, 1959).

SPANISH SARDINE
(Sardinella anchovia)

It ranges from Cape Cod to southern Brazil, including the Gulf of Mexico, Caribbean Sea, Bermuda, Bahamas, and West Indies. It is normally found close to the coast, well within the 50-fathom curve, but it has been caught as far offshore as the 200-fathom line in the Atlantic.

Roithmayr (MS) has shown that the two western Atlantic forms may be either valid species or seasonal races of a single species. Both forms coexist in the coastal waters of the Gulf of Mexico, Trinidad, and Brazil. Until this taxonomic problem is solved, and for the purpose of this report, it is referred to as Sardinella anchovia.

This silvery-blue fish is harvested with beach seines along the west and northwest Florida coasts for bait in the sport fishery. Yearly production is under 150,000 pounds, worth less than $5,000 (Figure 6). The increasing trend in yield from 1960 to 1968 is more than likely due to an increase in sports fishing; the species is one of the major sources of bait in west Florida. The fishery takes advantage of the numerous schools close to the beach during spring and summer. Usually in late fall and winter, the fish move offshore and probably migrate southward.

Diver observations around submerged structures indicate that this species mixes freely with round scad and, to some extent, with scaled sardine. Fishing captains indicate they catch Spanish sardine and round scad together.

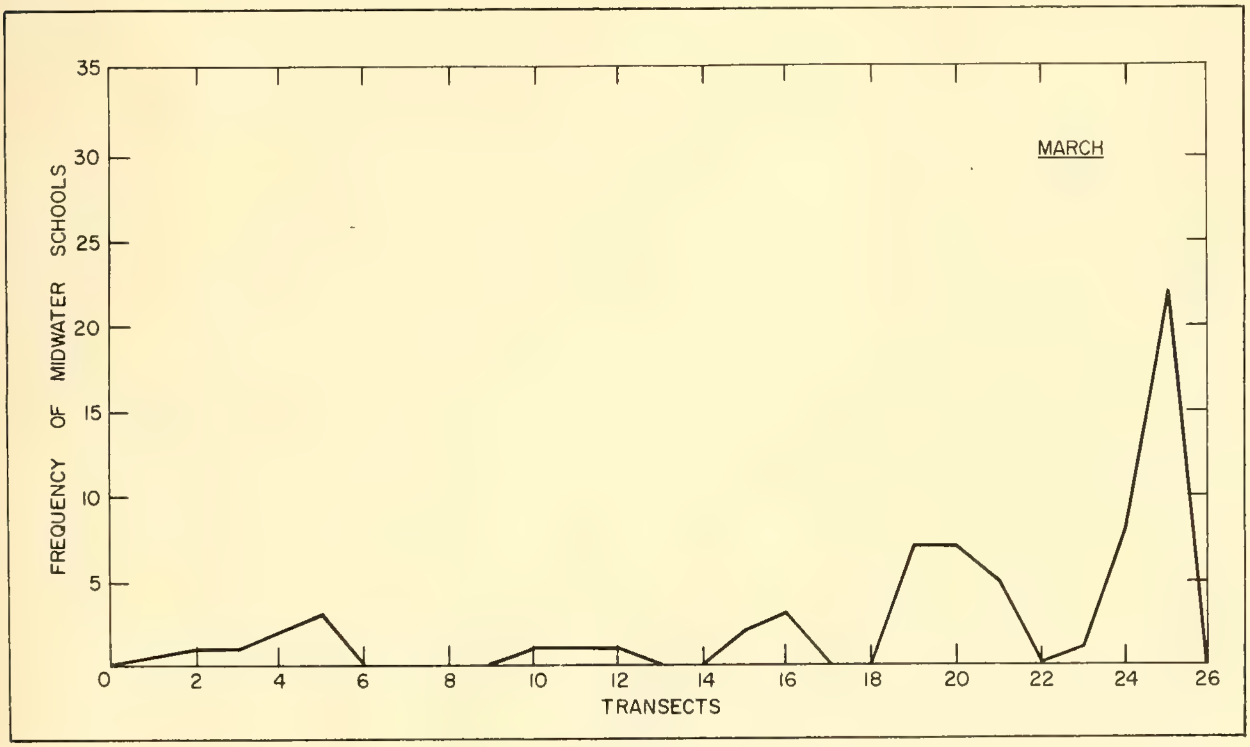

Fig. 2 - North-south distribution of midwater fish schools in March, Transect 1, Cape Hatteras through Transect 26, Cape Kennedy.

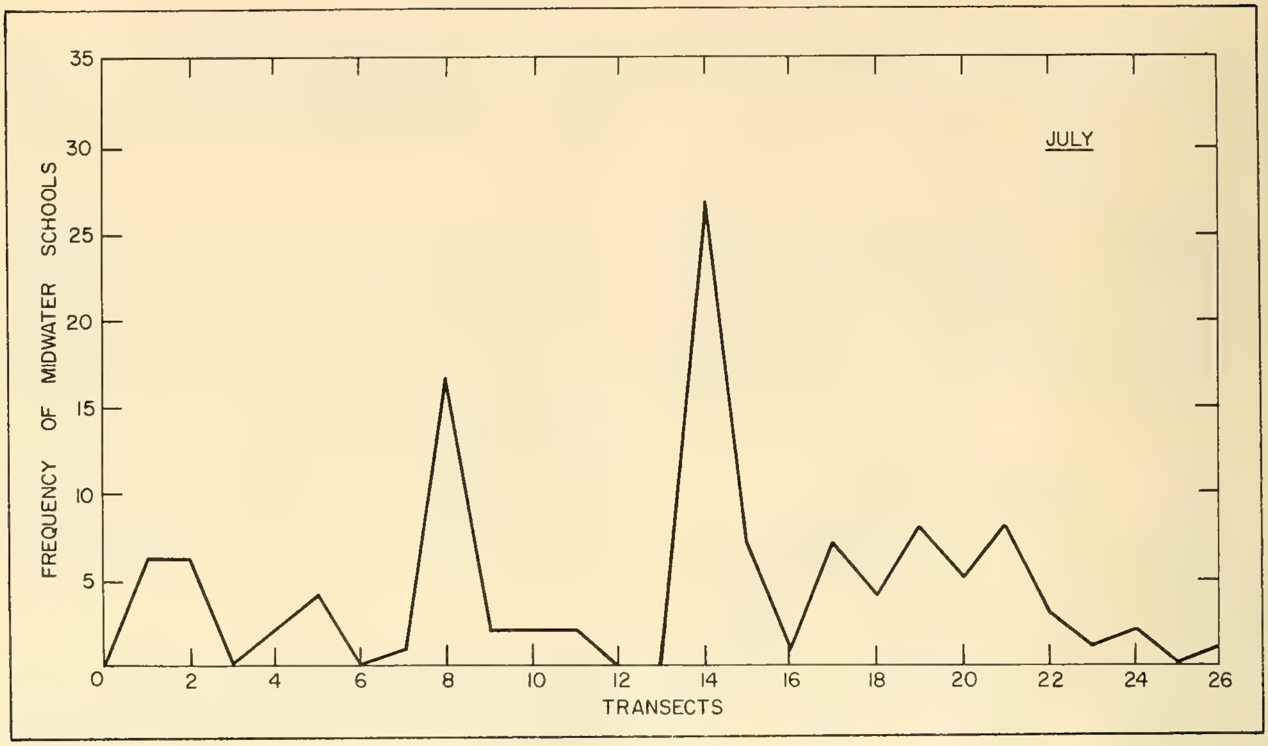

Fig. 3 - North-south distribution of midwater fish schools in July, Transect 1, Cape Hatteras through Transect 26, Cape Kennedy.

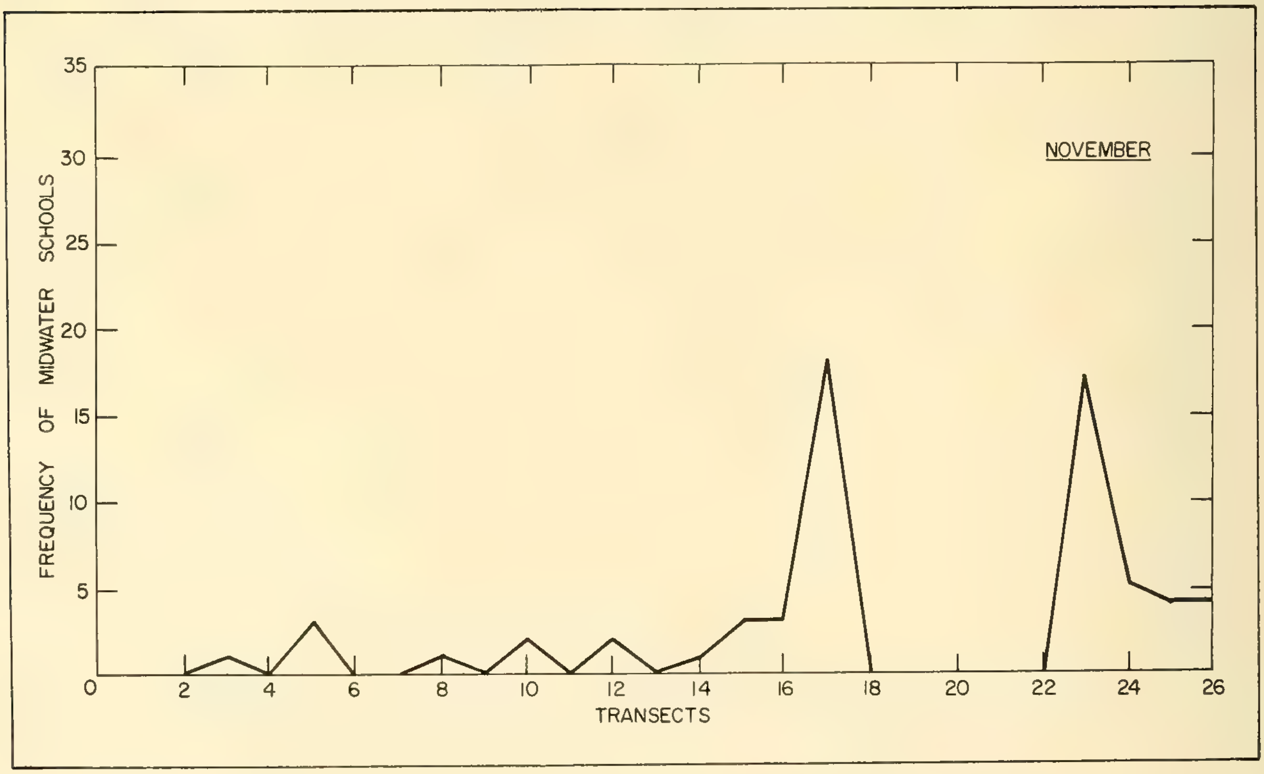

Fig. 4 - North-south distribution of midwater fish schools in November, Transect 1, CapeHatteras through Transect 26, Cape Kennedy.

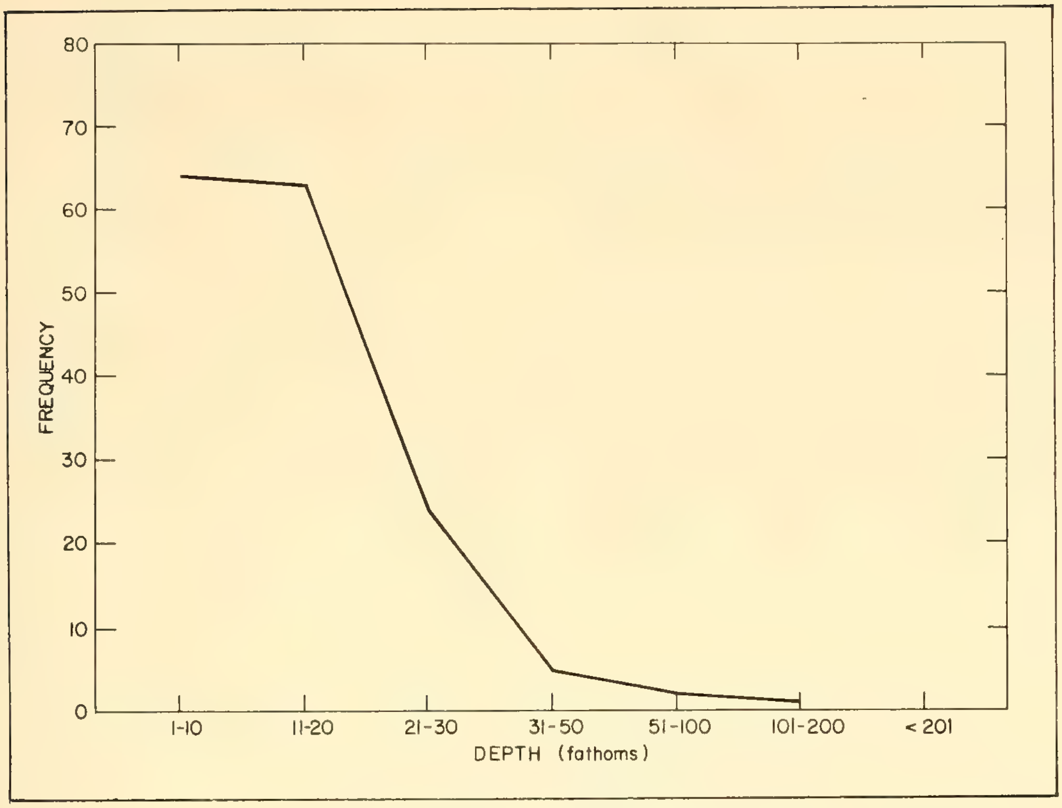

Fig. 5 - Depth distribution of scaled sardines in faunal zone 6.

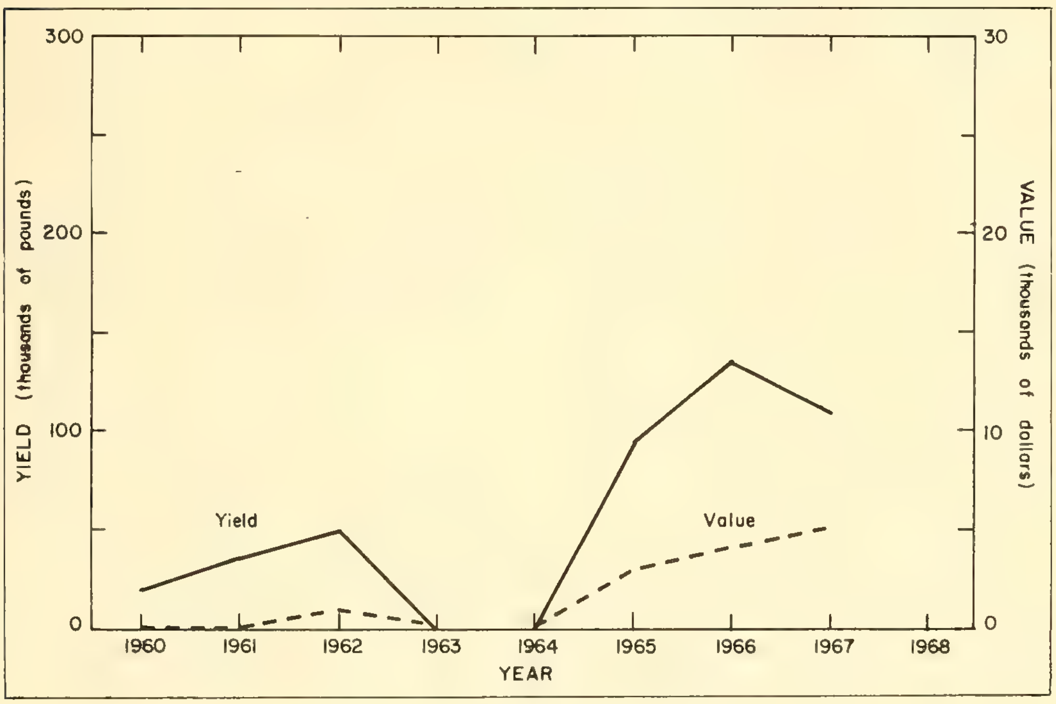

Fig. 6 - Gulf of Mexico Spanish sardine catch.

Harvested in Venezuela & Brazil

The only other countries where this species is commercially harvested are Venezuela and Brazil. There, they are canned for human consumption and/or iced for bait in tuna long-line fishing (Simpson and Griffiths, 1967). This species supports Venezuela's most important commercial fishery with annual catch usually in excess of 40,000 tons valued at about $700,000.

Sardines are fished by beach seines and, usually, one set catches the entire school. Sets of 400 tons have been reported, but sets are usually under 100 (Simpson and Gonzalez, 1967). Simpson and Griffiths (1967) indicate that although beach seines are well suited for the Gulf of Cariaco, the fishery does not fully exploit the resource. They recommend the development of modern and mobile harvesting gear to replace beach seines if there is an increase in demand for the processed sardine product (i.e., canned sardines).

ROUND HERRING
(Etrumeus teres)

The round herring is known to occur from Maine throughout the Gulf of Mexico to at least the Yucatan Peninsula. Hildebrand (1963) states that it rarely occurs north of New Jersey but, several times since 1900, it has been extremely abundant off Woods Hole, Massachusetts; at least 200,000 pounds have been landed along the coast of Maine. This fish is fairly common along the eastern seaboard, southward around Florida, and very common throughout the Gulf of Mexico to the Yucatan Peninsula. It has not been observed, however, along the Central American coastline. It has been collected by exploratory vessels between the 100- and 300-fathom isobaths off Colombia and Venezuela in faunal zones 14 and 15.

In the northern Gulf, it occurs out to at least the 200-fathom curve, but it is concentrated mainly between the 10- and 30-fathom curves.

SILVER ANCHOVY
(Anchoviella eurystole)

The silver anchovy ranges from Woods Hole, Massachusetts, southward to Beaufort, North Carolina (Hildebrand, 1963). During some summers, it is fairly common at Woods Hole, while during other summers it is absent. It appears only occasionally off Connecticut, New York, and New Jersey.

In the northern Gulf of Mexico, it has been caught occasionally with bottom trawls. During the winter, it often has been caught with nightlights and lift nets between the 20- and 30-fathom curves.

BUTTERFISH
(Poronotus triacanthus)

Butterfish are now important as food in most areas along the eastern seaboard of the United States. Bigelow and Schroeder (1953) state that this is one of the better table fish. It is also used as a commercial scrap fish in various processed forms, and as a crab bait and fertilizer. It is caught along the northeast coast with pound nets, floating traps, purse seines, and otter trawls. It is not harvested extensively in the Gulf of Mexico, except as an insignificant part of the industrial catch in the northern part (Roithmayr, 1965).

According to Caldwell (1961) and Haedrich (1967), this species ranges from the outer coast of Nova Scotia and Cape Breton, northward as a stray to the Gulf of St. Lawrence, and southward to Cape Kennedy, Florida. It appears to be absent around southern Florida and, in the Gulf, the species ranges from Cape Romano along the coast to the Yucatan Peninsula.

This beautiful silvery fish occurs at the surface, in midwater, or at or near the bottom, but it is classified as a midwater pelagic. Exploratory records and Caldwell's findings indicate that in the Gulf of Mexico butterfish are found in shallower waters more frequently than in the Atlantic. Table 1 shows distribution patterns by season and depth in zones 1 through 7, where no seasonal onshore-offshore movement is shown.

CHUB MACKEREL
(Scomber japonicus)

One of the smaller species of mackerels, it grows to a length of 35 cm, or about 14 inches. Bigelow and Schroeder (1953) agree that its appearance, schooling, and feeding habits are similar to that of the northern mackerel, Scomber scombrus. It occurs in warm and temperate parts of the Atlantic, north to the Gulf of St. Lawrence and south around the tip of Florida, and the Gulf Coast

to at least the Yucatan Peninsula. Chub mackerel have not been reported from south of the Yucatan Peninsula to the Venezuela coast (zones 10 to 12), but its distribution is continuous along the northern part of South America (zones 13 to 16). Before 1951, this species had never been reported south of Virginia, but Rivas (1951) recorded it as S. colias from Garden Key, Florida, and off Cuba, and Simpson and Griffiths (1967) off Venezuela.

The depth distribution of this species in the northern Gulf of Mexico is from about 5 to 200 fathoms (Figure 7). In faunal zone 6, it appears to concentrate between 11 and 30 fathoms; in zone 7, it appears to concentrate between 11 and 50 fathoms.

Chub mackerel are occasionally caught in the Gulf of Maine, but sporadic occurrence in that area probably limits its commercial potential. Bigelow and Schroeder (1953) reported that in this area there have been times of great abundance followed by long periods of scarcity. It is not harvested in other parts of its range, except off Venezuela (Simpson and Griffiths, 1967).

Table 1 - Butterfish catch records of exploratory fishing with trawl by depth and season in faunal zones 1 through 7

Zone/season		Depth (fms.)						
		1-10	11-20	21-30	31-50	51-100	101-200	201 +
1	Jan.-Mar.	-	1	4	5	4	-	-
	April-June	-	2	-	5	4	-	-
	July-Sept.	-	-	-	-	3	2	-
	Oct.-Dec.	-	-	-	-	-	-	-
2	Jan.-Mar.	32	13	-	5	6	6	-
	April-June	9	3	1	6	3	1	-
	July-Sept.	31	-	3	-	2	2	-
	Oct.-Dec.	-	-	-	-	-	-	-
3	Jan.-Mar.	14	12	9	14	14	14	3
	April-June	-	-	12	9	7	31	3
	July-Sept.	4	9	2	5	5	10	2
	Oct.-Dec.	10	4	2	4	10	13	2
4	Jan.-Mar.	22	11	27	28	8	2	-
	April-June	-	1	7	6	-	-	-
	July-Sept.	15	1	3	6	-	-	-
	Oct.-Dec.	14	-	2	3	-	-	-
5	Jan.-Mar.	1	2	8	2	1	-	-
	April-June	-	3	-	-	-	-	-
	July-Sept.	-	-	1	2	-	-	-
	Oct.-Dec.	-	-	-	-	-	-	-
6	Jan.-Mar.	41	43	53	35	6	1	-
	April-June	15	5	3	7	3	6	-
	July-Sept.	6	23	22	10	3	4	3
	Oct.-Dec.	21	14	7	11	3	-	-
7	Jan.-Mar.	8	8	11	45	5	1	-
	April-June	10	11	9	2	2	-	-
	July-Sept.	49	44	23	75	10	-	-
	Oct.-Dec.	1	-	2	4	1	-	-

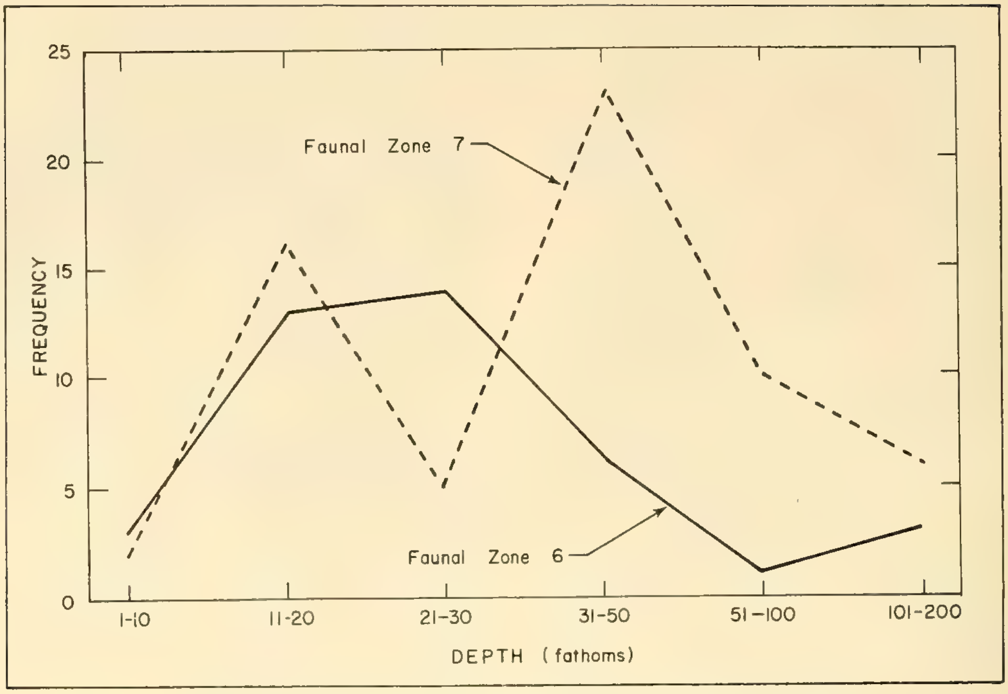

Fig. 7 - Depth distribution of chub mackerel in faunal zones 6 and 7.

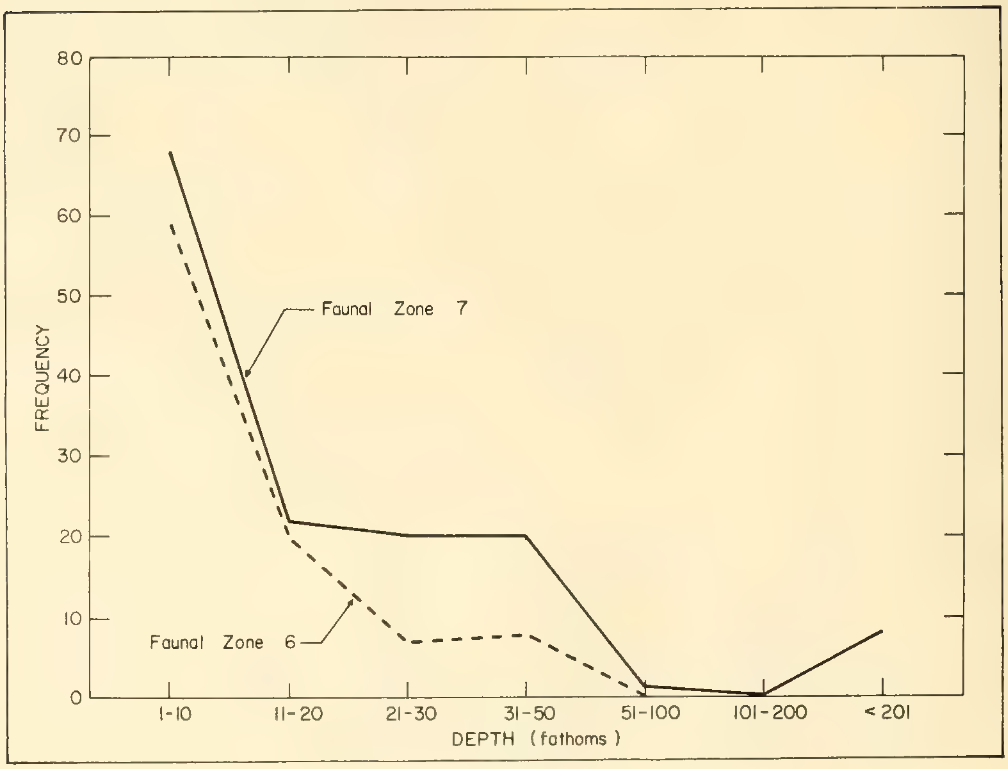

Fig. 8 - Depth distribution of bumpers in faunal zones 6 and 7.

BUMPER
(Chloroscombrus chrysurus)

This very common fish occurs from Cape Cod southward throughout the Gulf of Mexico. Bumpers are also found in the Caribbean Sea to Brazil (Ginsburg, 1952). It is commonly caught with beach seines in northwest Florida, and with shrimp trawls throughout most of the Gulf of Mexico. Although most commonly found within 10 fathoms, it occurs offshore to at least the 1,000-fathom curve in the northern Gulf, and out to the 500-fathom curve off northeast Florida. Throughout the rest of its range, it is rarely found beyond the 50-fathom isobath (Figure 8).

ROUGH SCAD
(Trachurus lathami)

It is known from nearly all warm and temperate seas, and along our Atlantic coast from Cape Cod southward to Brazil. The rough scad is rare in the northern part of its range, but it is fairly common off the Florida Keys and in the northern Gulf of Mexico east of the Mississippi Delta.

It is generally found slightly farther offshore than other coastal pelagic species, most commonly between the 30- and 50-fathom contours (Figure 9).

ROUND SCAD
(Decapterus punctatus)

This fish is usually found in small schools along the Atlantic seaboard from Nova Scotia to Brazil, including the Gulf of Mexico, the West Indies, and Bermuda. Berry (1968) indicates that its distribution is continuous. Juveniles are pelagic and may prefer oceanic rather than coastal waters, but they do occur around oceanic islands. Throughout its range, it can be found from the shore out to the Continental Slope.

In faunal zones 6 and 7, in the northern Gulf of Mexico, its seasonal depth distribution is shown in Table 2 and Figure 10. During the winter, it is found mostly beyond the 20-fathom curve to 50 fathoms. In the spring, however, it is concentrated within the 10-fathom curve. In the summer, it appears to move farther offshore and concentrate, at least in faunal zone 6, between the 11- and 20-fathom contours. During the fall, it again moves inshore close to the beach, but it is more or less uniformly distributed from the shore line out to about the 100-fathom contour.

Caught For Bait

Rough scad are caught for bait with beach seines along the Florida panhandle from April to November. Since 1960, production and value have increased because of the increase in demand for bait fish (as mentioned with Spanish sardine). In 1967, more than $\frac{1}{2}$ million pounds worth slightly more than $65,000 were landed (Figure 11). More than 60 percent of the annual yield is produced in June and July.

During the summer, this species schools off northwest Florida with the Spanish sardine and, to some extent, with the scaled sardine. Klima and Wickham (1971) have observed dense schools of mixed round scad and rainbow runner, Elagatis bipinnulatus, around submerged structures.

THREAD HERRING
(Opisthonema oglinum)

This tropical and subtropical fish occurs intermittently along the eastern seaboard from Cape Cod to southern Brazil. It is usually found from 4 to 50 fathoms. In the northeastern Gulf of Mexico, it is most commonly found within the 20-fathom curve (Figure 12). Bullis and Thompson (1967) estimate the density of thread herring in this area to be one school per square mile. Observations in the northern Gulf indicate that thread herring stocks are not as numerous there as off Florida's west coast.

Commercial interest in the thread herring stocks was stimulated by an off-season aerial survey for menhaden conducted by the Bureau of Commercial Fisheries during the winters of 1963-64, 1964-65, and 1965-66 (Thompson, 1968). During 15 monthly flights, 5 each winter season, over traditional menhaden grounds along the west coast of Florida, almost 1,800 schools were observed. Almost 900 schools of thread herring were observed south of 29° N latitude during these flights. Other schools were comprised of scaled sardine, Spanish sardine, and yellowfin menhaden. Species identification of the schools was made from coordinated gill-net samplings.

Possibly Million Tons

Based on average catch rates of commercial sets, an extrapolation indicates a possible thread herring stock of about one million tons (Bullis and Thompson, 1967). During the Bureau's exploratory fishing, thread herring

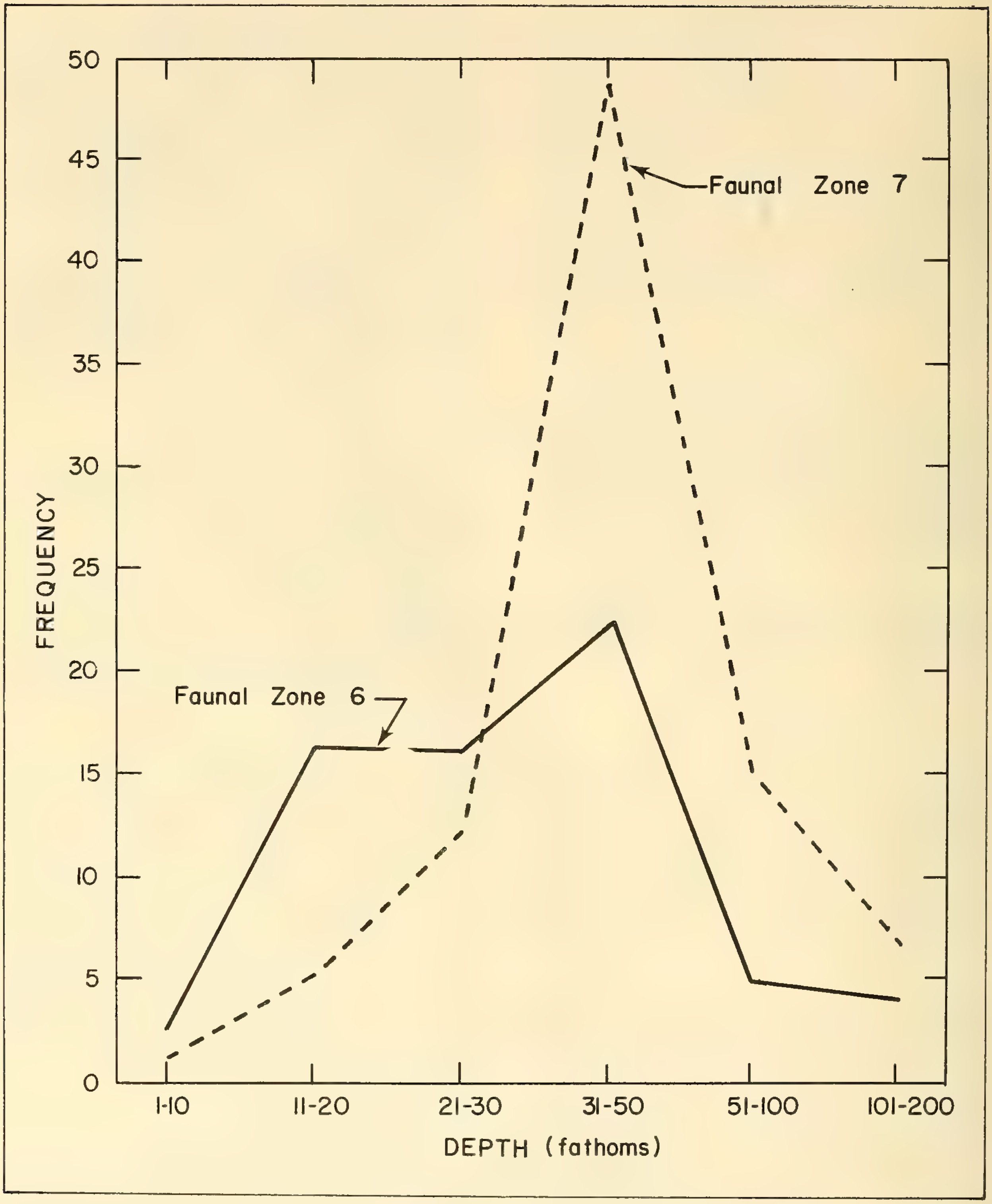

Fig. 9 - Depth distribution of rough scad in faunal zones 6 and 7.

Table 2 - Round scad catch records of exploratory fishing with trawl by depths and season in faunal zones 6 and 7

Zones	Depth (fms.) 1-10	11-20	21-30	31-50	51-100	101-200	200 +	Total
6								
Jan.-Mar.	2	25	32	34	6	1	-	100
April-June	11	4	1	1	2	1	-	20
July-Sept.	1	19	12	5	1	-	-	38
Oct.-Dec.	10	16	8	11	6	-	-	51
7								
Jan.-Mar.	-	4	4	27	2	-	-	37
April-June	3	5	5	3	1	-	-	17
July-Sept.	1	25	13	57	12	-	-	108
Oct.-Dec.	13	12	11	13	-	-	-	49

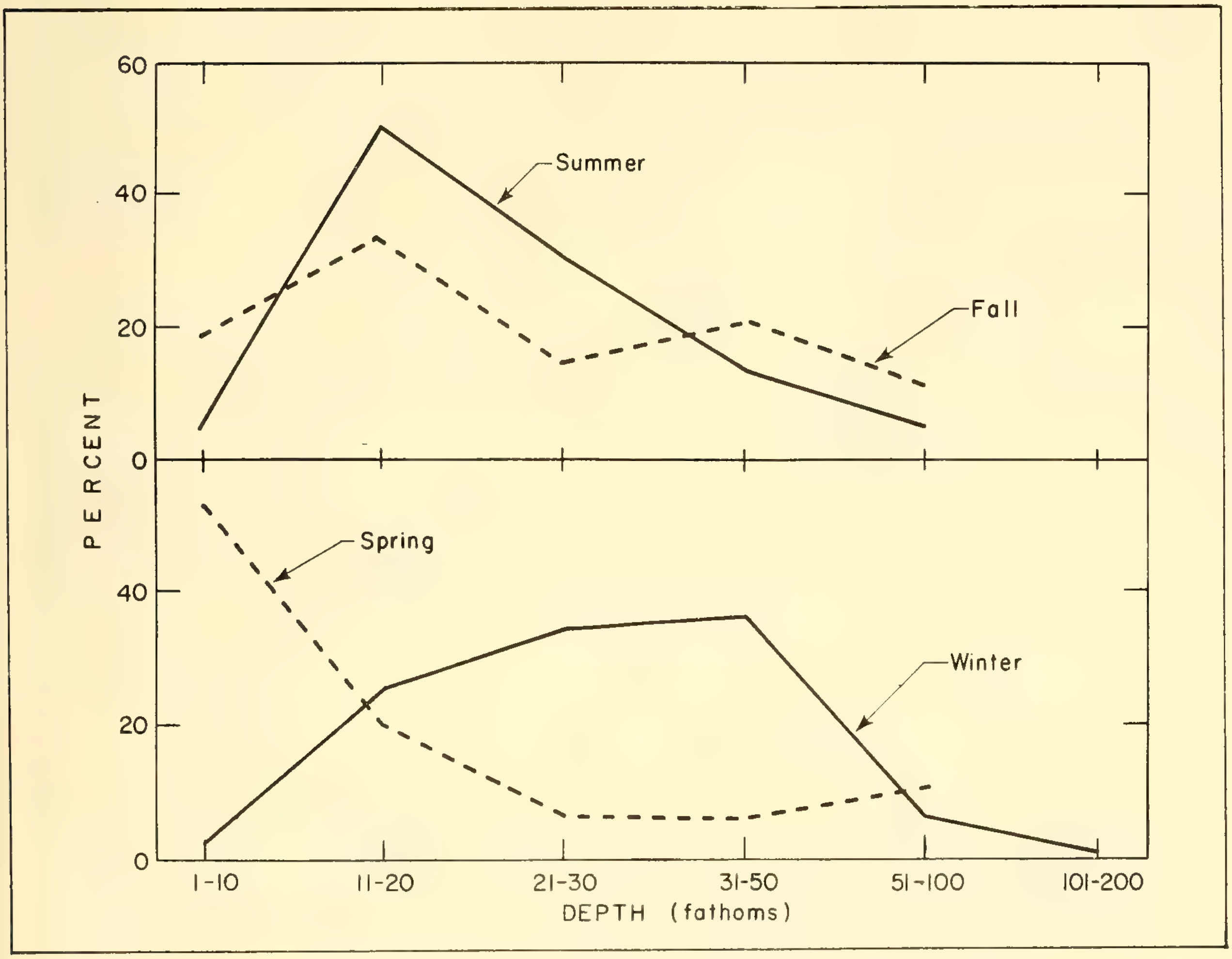

Fig. 10 - Depth distribution of round scad by season in faunal zone 6.

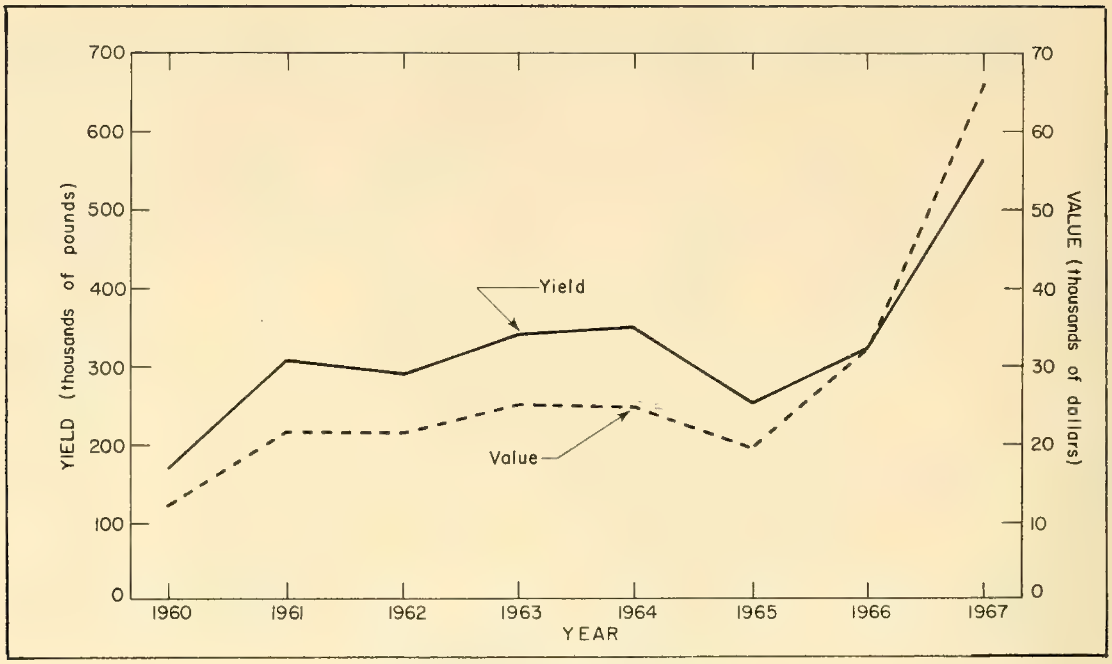

Fig. 11 - Gulf of Mexico round scad catch.

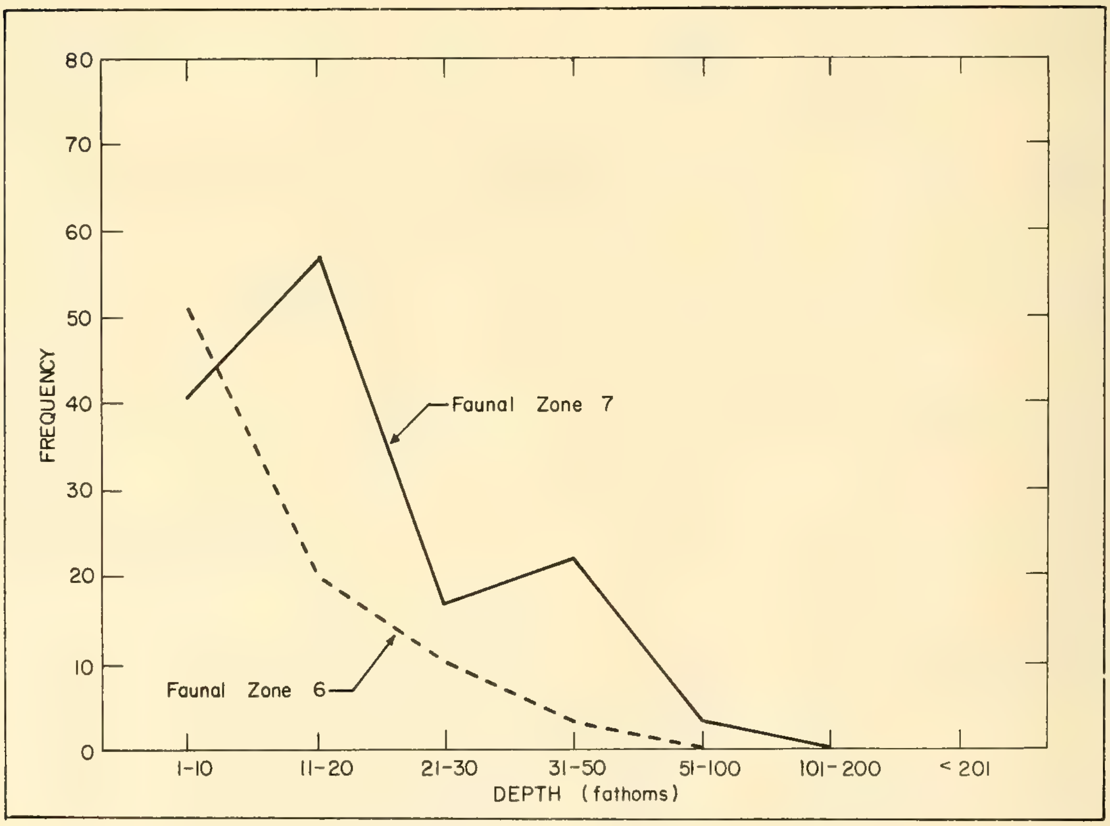

Fig. 12 - Depth distribution of thread herring in faunal zones 6 and 7.

were caught in all areas of the Atlantic south of Cape Hatteras, and throughout the entire Gulf of Mexico. Catches occurred throughout every season from the Mississippi Delta to the east coast of Florida, and off Louisiana and Texas in every month except June, July, and December. Thread herring are most numerous in the summer and fall in the latter area.

Thread herring has perhaps the best immediate commercial potential because moderate amounts already have been harvested along Atlantic coast, off Fernandina Beach, Florida, and off Fort Myers in the Gulf by menhaden fishermen. Accurate catch statistics are not available since small catches and/or catches mixed with menhaden are usually recorded as menhaden (Butler, 1961).

In addition to gear problems, perhaps the greatest were the problems of disposing the catch. The fish were transported to Apalachicola, Florida, and Pascagoula, Mississippi, for processing into fish meal and pet food. The long distance between catching and processing areas added significantly to the raw material cost and caused serious logistical problems.

Some Industry Harvesting

Since 1958-1959, limited efforts have been made by industry to harvest thread herring off the west coast of Florida (Fuss, et al., 1969) using lampara seines and one-and two-boat purse seines. In 1967, a significant effort was made to harvest the west Florida stocks when a processing plant was built at Charlotte Harbor near Fort Myers, Florida. Fishing operations were conducted with standard two-boat menhaden purse seiners and a modified shrimp vessel. There were gear problems and fishing was limited to small, smooth-bottom areas close inshore from Gasparilla to Sanibel Islands.

In 1967 and 1968, the vessels of three different companies produced about 15,000 tons of thread herring. The limited-capacity plant at Charlotte Harbor handled a good part, and plants at Dulac, Louisiana, and Apalachicola, Florida, also processed part. Catches were transported to the two distant plants in large (up to 500-ton capacity) refrigerated menhaden vessels.

Legal Restrictions & Weather

Legal restrictions and weather also limited production in the area during 1967 and 1968. Florida laws prohibit catching of foodfish by purse seines within Florida's 10.5 mile jurisdiction, and insignificant catches of these (usually predators) were made in the thread herring sets. This greatly curtailed fishing until catch monitoring by the Bureau of Commercial Fisheries showed that foodfish represented less than one percent of the catch.

In February 1968, the State Board of Conservation permitted resumption of purse seining for thread herring within those limits. By then, however, those vessels with the largest harvesting capabilities had become discouraged and returned to menhaden fishing.

Also, recent legislation has effectively closed this fishery by prohibiting purse seines in state waters along Florida's central and lower Gulf coast. Kinnear and Fuss (MS) stated that prospects for continuing the thread herring purse-seine fishery from outside state waters are discouraging because the fish do not appear to school in offshore waters, and present gear is not capable of harvesting them.

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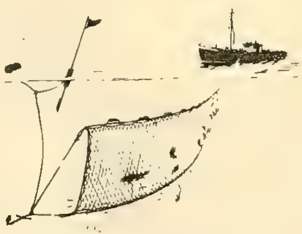

THE ATLANTIC SURF CLAM FISHERY - 1969

Allan M. Barker and John W. Ropes

The 1969 surf-clam fishery produced record landings of 49.6 million pounds of meats--9.7 million pounds more than in 1968. The New Jersey catch of 38.8 million pounds, an increase of 7.0 million pounds, almost equaled the total landings for 1968. Maryland and New York landings increased by 7.1 and 3.7 million pounds, respectively. The fleet size expanded and the southward shift continued. The number of vessels decreased at Point Pleasant, N.J., but increased at Cape May-Wildwood, N.J., and at Ocean City, Md.

FISHING AREAS

Cape May-Wildwood, N.J., and Point Pleasant, N.J., were the major surf-clam fishing areas in the middle Atlantic bight in 1969; Ocean City, Md., and Long Island, N.Y., provided the remainder of the catch. The New Jersey fishery continued to contribute most of the total landings, although the 38.8 million pounds landed were a smaller percentage (78%) than in 1968 (Table). Landings from the Cape May-Wildwood area were almost twice those from Point Pleasant.

SURF CLAM LANDINGS BY AREAS (1969)

Area	Number of Vessels		Landings (Millions of lbs.)	
	1968	1969	1968	1969
Cape May-Wildwood, N.J.	42	43	18.0	24.8
Point Pleasant, N. J.	30	28	13.8	14.0
Ocean City, Md.	7	14	5.2	7.1
Long Island, N.Y.	7	7	2.9	3.7
Total	86	92	39.9	49.6

The areas fished by New Jersey boats in 1969 (Fig. 1) were similar to 1968 (Yancey, 1970) but more trips were made to the southern areas. The Ocean City, Md., vessels worked mostly inshore and north of the Ocean City inlet, as in 1968. The Long Island, N.Y., surf-clam landings were taken off Long Beach and Fire Island.

FLEETS AND METHODS

The New York fleet remained at 7 vessels (as in 1968) until late in the year, when one moved to New Jersey. The fleet, based at Freeport, L.I., consisted of 5 full-time and 2 part-time vessels; the latter landed clams for fish bait. Average catch per trip for the full-time vessels was 182 bushels (3,000 pounds of meats). Total landings of 3.5 million pounds of meats for food and 0.2 million pounds for bait resulted from average monthly landings of 180,000 to 575,000 pounds of meats.

The Point Pleasant fleet decreased for the third consecutive year--the 28 vessels were 2 less than 1968. Boats operating out of Atlantic City were included in the 1969 total because they fished the same beds as the Point Pleasant fleet. Depths fished ranged from 12 to 37 meters (40 to 120 feet); average depth was 23 meters (76 feet). Most vessels made 1-day trips, but some overnight trips were made to more distant grounds. Hours fished per boat-day ranged from 3 to 22. Monthly averages are shown in Figure 3. The average for 1969 was 9.5 hours, a decrease of 0.3 hour from 1968.

The Cape May-Wildwood fleet increased to 43, one more than 1968. Two large stern-dredgers started operating in 1969. Depths fished ranged from 7 to 35 meters (22 to 114 feet); average depth was 14 meters (46 feet).

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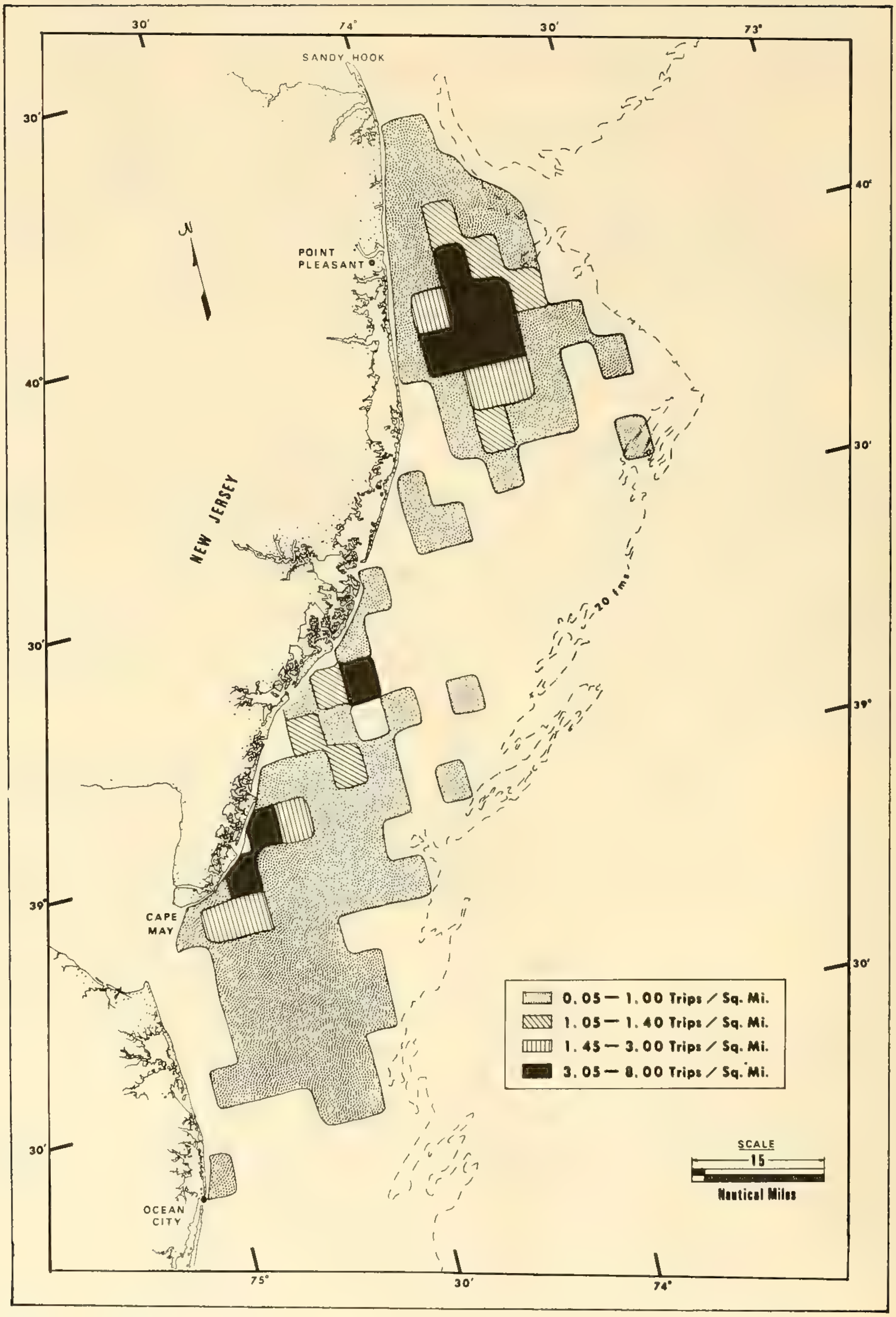

Fig. 1 - Area and intensity of surf-clam fishing by New Jersey fleet, 1969 (based on 1,955 interviews).

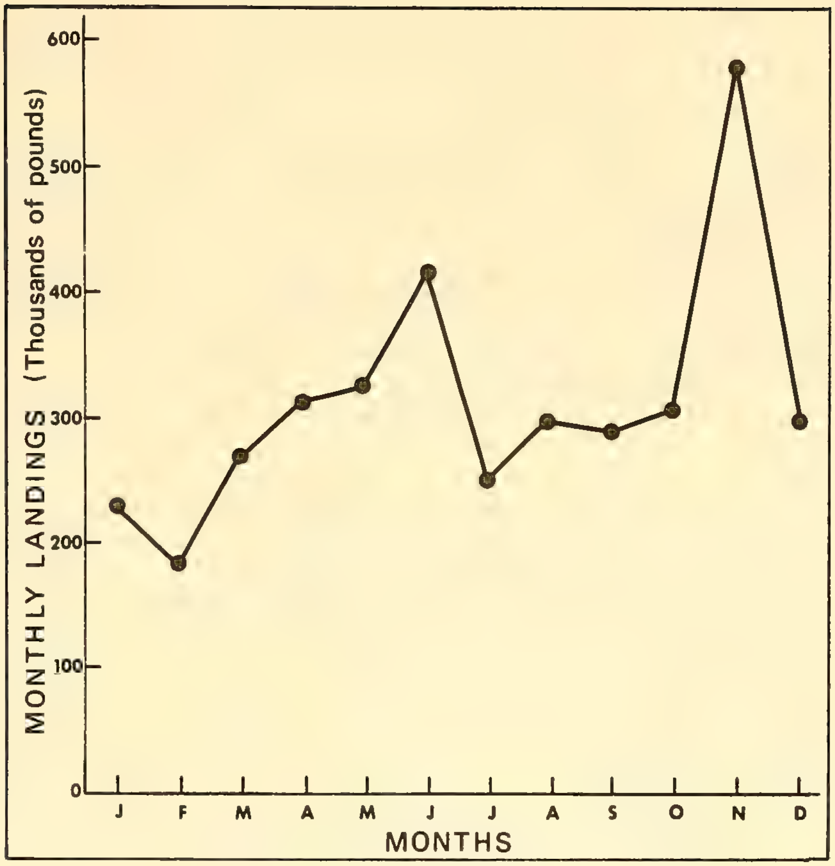

Fig. 2 - Monthly landings of surf clams in New York, 1969.

Most vessels made 1-day trips and worked during daylight hours. Monthly averages of hours fished per boat-day are shown in Figure 3. Daily effort ranged from 2 to 20 hours. The average for 1969 was 7.2 hours, a decrease of 0.7 hour from 1968. During the last half of 1969, 2 to 4 boats landed clams at Lewes, Del., the first landings there since 1962. These values were included with those for Cape May-Wildwood because 2 of the vessels were based at Wildwood and all of the clams came from the areas fished by the Cape May-Wildwood fleet.

The Ocean City fleet expanded to 14 vessels, an increase of 7 from 1968. Landings of 7.1 million pounds of meats in 1969 were the direct result of additional vessels using the port (Fig. 4). No interview data were available to determine catch and effort by boat.

NEW JERSEY LANDING STATISTICS

Interviews by a port sampler provided information on fishing areas and effort in New Jersey. Landings in the middle Atlantic bight were supplied by the NMFS Division of Statistics and Market News.

Record landings of 49.6 million pounds of meats were 9.7 million pounds higher than in 1968 (Table). Most of the increase was due to the greater poundage (6.8 million pounds) landed by the Cape May-Wildwood fleet. New Jersey produced 38.8 million pounds--7.0 million pounds more than in 1968. Maryland and New York landings also increased (1.9 and 0.8 million pounds). New Jersey landings were 78% of the 1969 total; Maryland, 14%; and New York, 8%. Contributions by the respective states in 1968 were 80%, 13%, and 7%. Less than 2% of the total catch was used for bait.

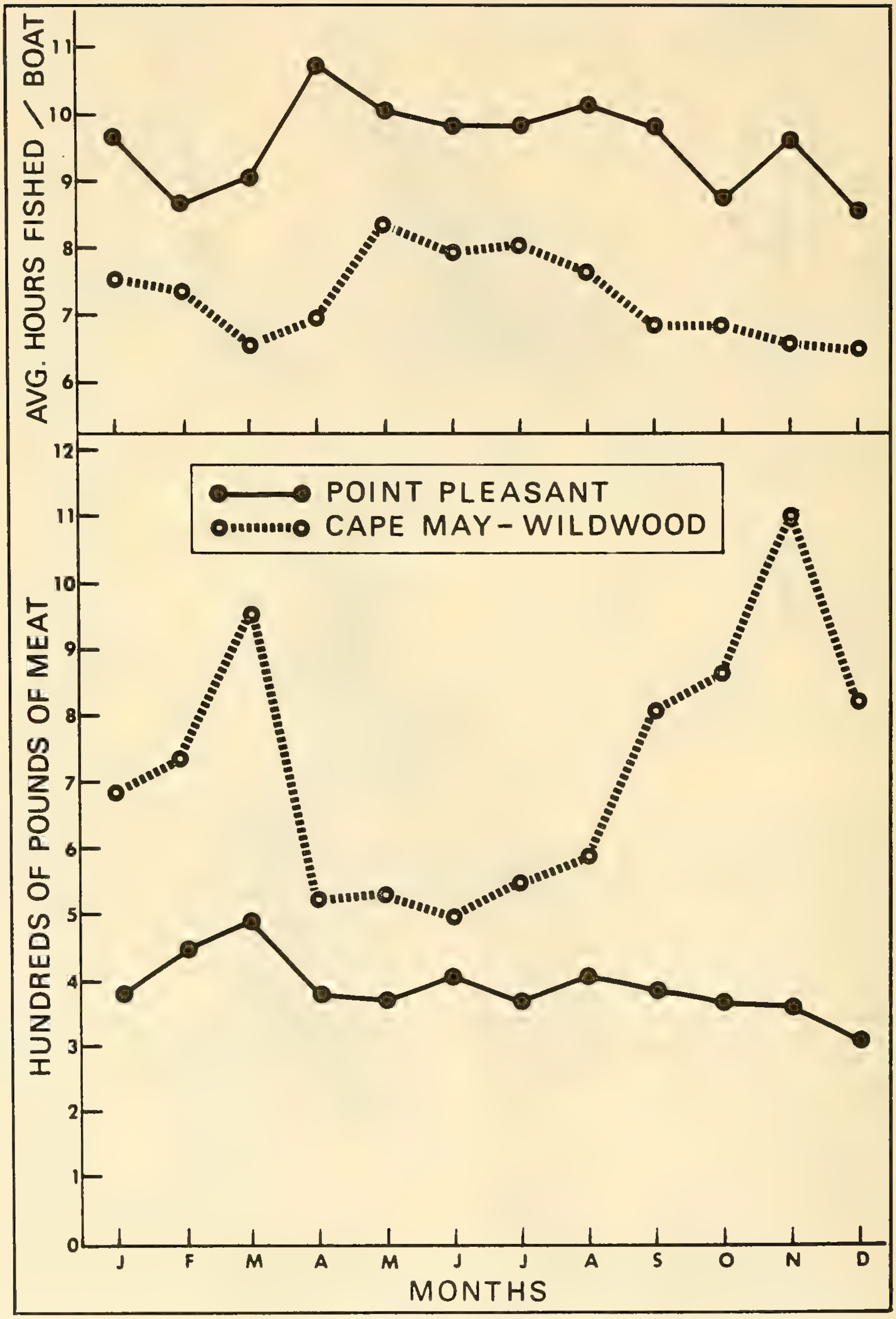

Fig. 3 - Monthly averages of daily effort (upper) and catch per hour (lower) at Point Pleasant and Cape May - Wildwood, N. J., 1969.

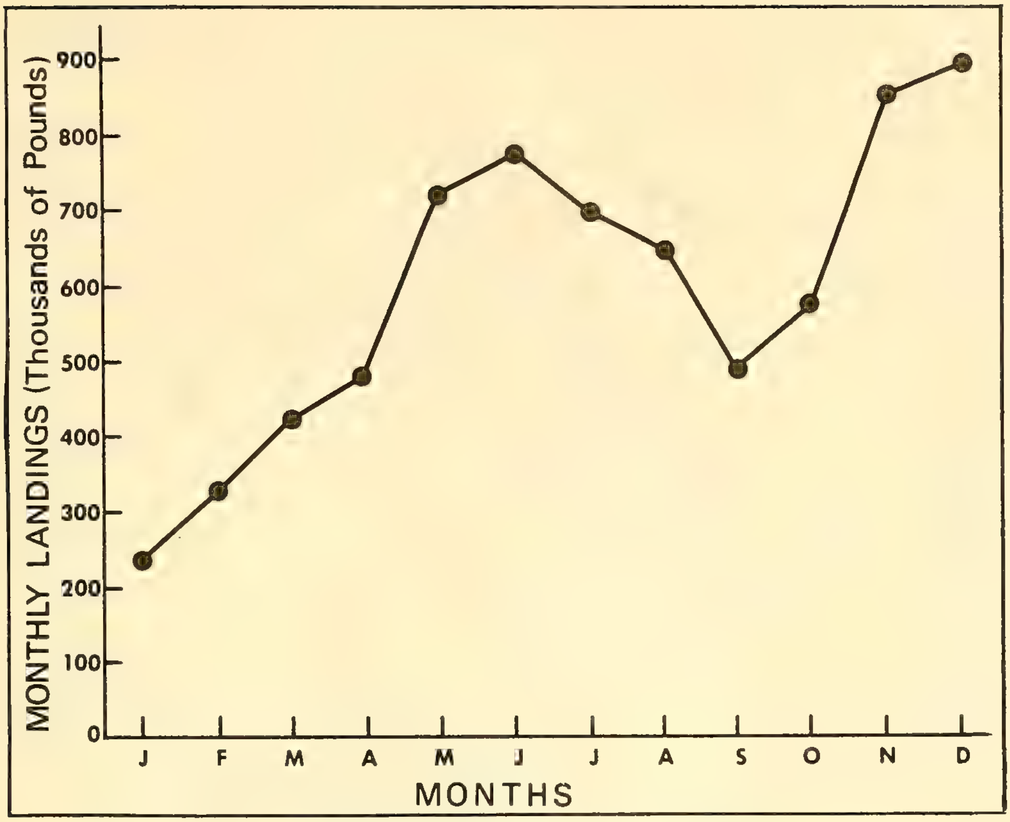

Fig. 4 - Monthly landings of surf clams in Maryland, 1969.

Cape May-Wildwood Fleet

Contributions to the total New Jersey landings by the Cape May-Wildwood fleet have increased markedly during the past 5 years. The number of vessels at Cape May-Wildwood and Point Pleasant was about the same as in 1968, but Cape May-Wildwood provided 62% (24.8 million pounds) in 1969--up from 57% in 1968. Much of the increase was due to the operation of 2 large stern-dredge vessels based at Wildwood.

At Cape May-Wildwood, landings per boat-day ranged from 43 to 1,400 bushels (731 to 23,800 pounds of meats) and averaged 289 bushels (4,913 pounds). The average in 1968 was 225 bushels (3,825 pounds). Monthly landings varied little except in March, when a dense bed of small inshore clams off Atlantic City was heavily fished (Fig. 5). Catch per hour increased from 28 bushels (476 pounds) in 1968 to 43 (731 pounds) in 1969. Figure 6 shows the catch per hour in the areas fished. The catch rate dropped sharply in May when the fleet moved offshore to fish for large (150 mm) clams (Fig. 5). About two-thirds of all trips made in 1969 were to inshore areas. The average catch rate for inshore and offshore clams was 48 bushels (876 pounds) and 26 bushels (442 pounds) respectively. Monthly average lengths reflected the seasonal shift in effort from inshore to offshore beds (Fig. 5). Lengths of clams landed ranged from 109 to 187 mm (4.3 to 7.4 inches). The average length of inshore clams was 131 mm (5.3 inches); offshore clams average 155 mm (6.2 inches) long; and the average for all clams measured was 137 mm (5.4 inches) or 10 mm (0.4 inch) less than 1968.

Point Pleasant

The Point Pleasant share of the New Jersey landings decreased from 43% in 1968 to 36% in 1969. Most of the decrease was due to the higher landings at Cape May-Wildwood (36% larger than 1968). Landings at Point Pleasant per day-trip ranged from 32 to 600 bushels (544 to 10,200 pounds of meats) and averaged 221 bushels (3,757 pounds). The average in 1968 was 233 bushels (3,961 pounds). Catch

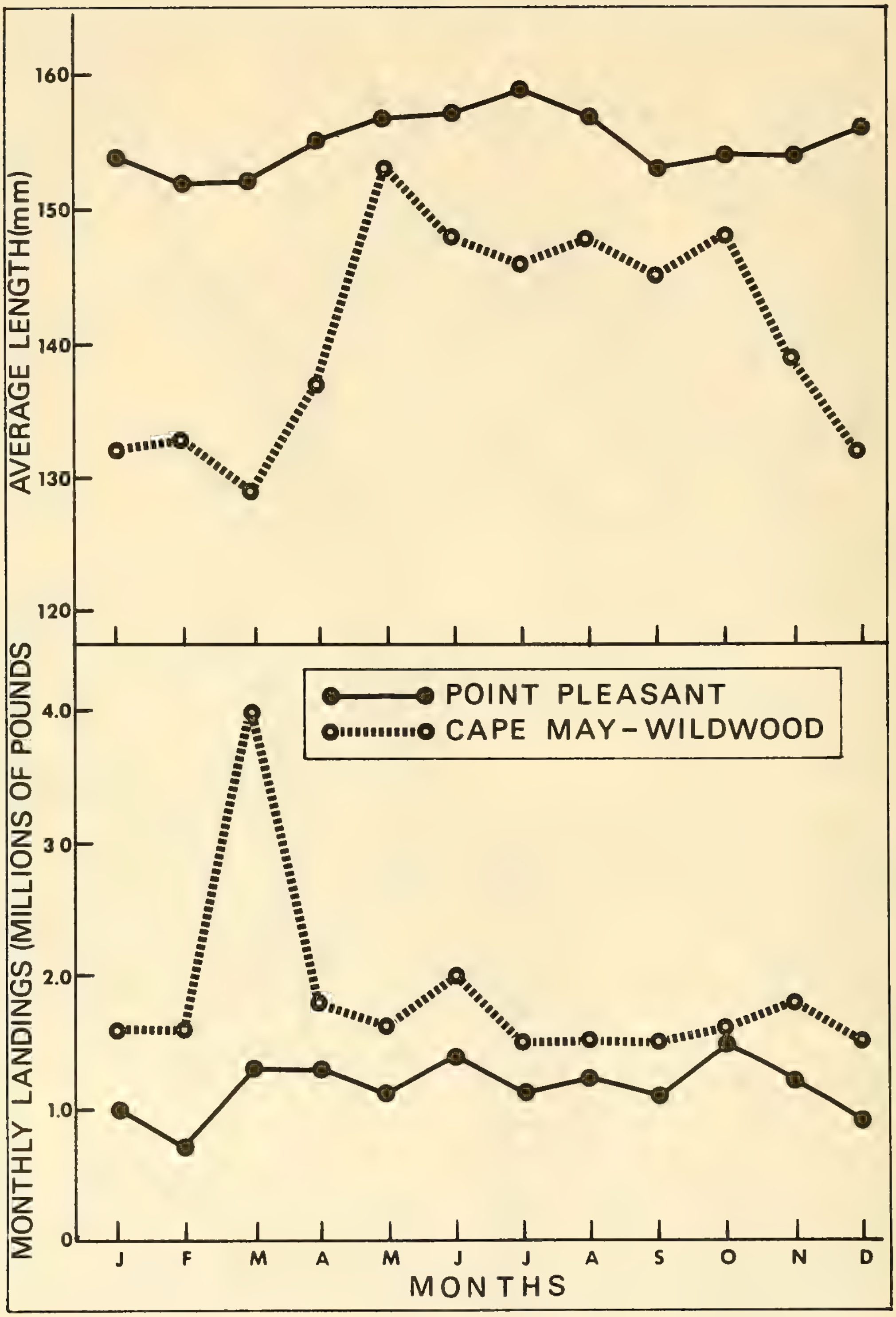

Fig. 5 - Monthly mean lengths of surf clams (upper) and landings (lower) in New Jersey, 1969.

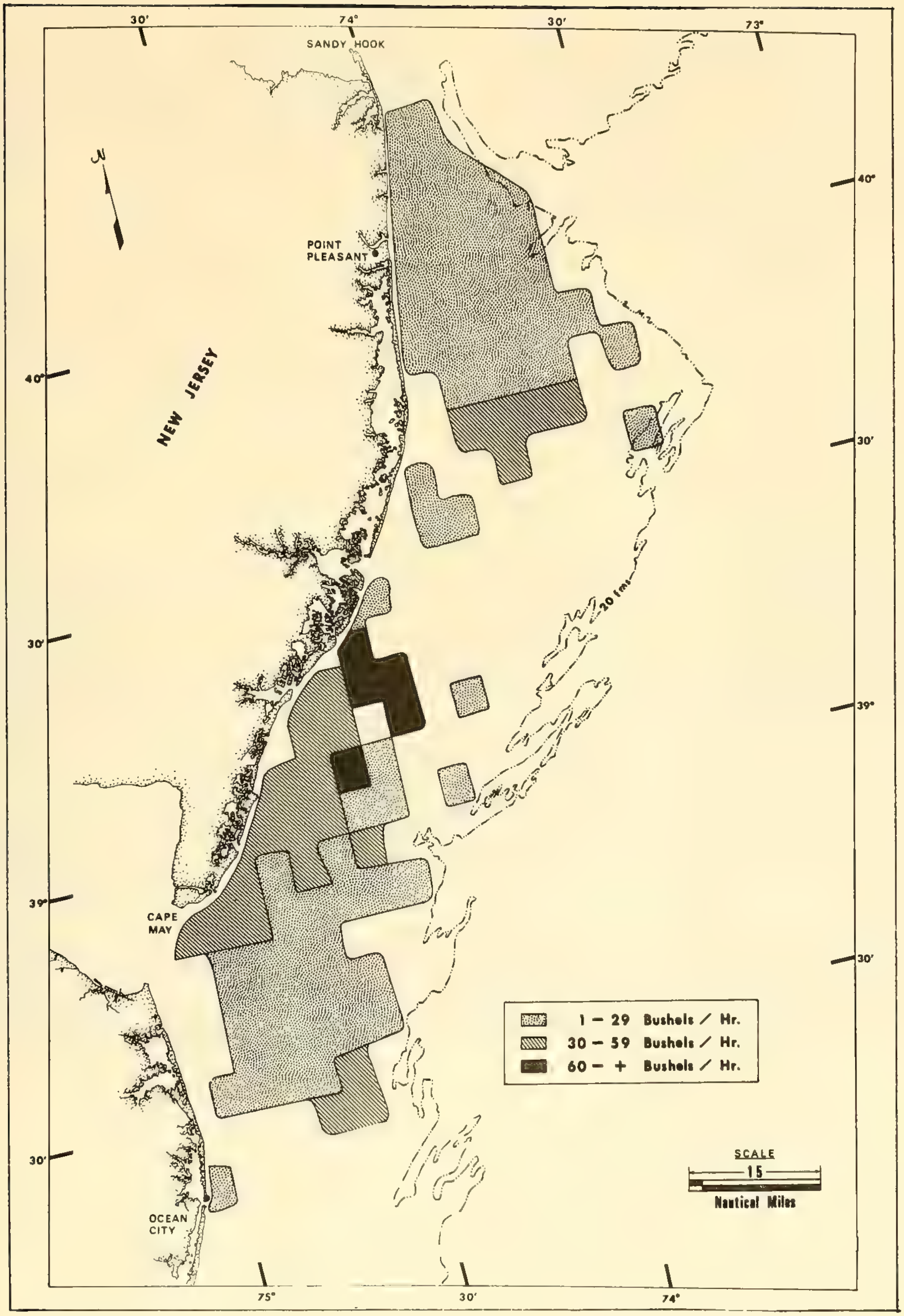

Fig. 6 - Catch per hour within the area fished by the New Jersey surf-clam fleet in 1969 (based on 1,955 interviews).

per hour averaged 23 bushels (391 pounds) in 1969 and 24 bushels (408 pounds) in 1968. Monthly catch rates and landings were relatively stable in 1969 (Fig. 5). Most of the variation was due to the effects of bad weather. Lengths of clams landed ranged from 116 to 203 mm (4.6 to 8.0 inches) and averaged 155 mm (6.2 inches) long in 1969. This average was 2 mm (0.1 inch) greater than 1968. Monthly average lengths were fairly constant throughout 1969 (Fig. 5).

STATUS & TRENDS OF THE FISHERY

Fishing effort increased in 1969. Although hours fished per trip by New Jersey vessels were slightly less than in 1968, about 6 more boats were added to the entire surf-clam fleet. The southward shift in effort, which started in 1967, continued in 1969. The Ocean City, Md., fleet expanded from 7 to 14 vessels. The Cape May-Wildwood fleet added 2 large stern-dredgers. The New York fleet remained at 7 vessels.

The catch rate at Point Pleasant decreased from 24 bushels per hour in 1968 to 23 bushels in 1969, but at Cape May-Wildwood the rate increased from 28 bushels to 43 bushels. The high rate at Cape May-Wildwood was due to an intense effort by the fleet on beds of small inshore clams and the operations of the stern-dredgers.

Average lengths of clams landed in New Jersey in 1969 were about the same as in 1968. Monthly averages at Point Pleasant showed minor variations during 1969; those at Cape May-Wildwood fluctuated with season because the fleet moved from offshore beds of large (150 mm) clams to inshore beds of small (120 mm) clams during the winter.

The gradual decline in landings at the Point Pleasant port will probably continue, but the Cape May-Wildwood and Ocean City fleets should expand and catch a greater percentage of the total landings. The New York fleet will probably stabilize at its present size.

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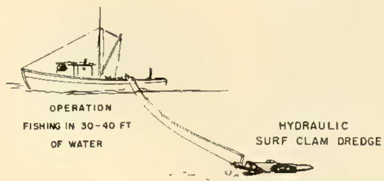

TRAPPING SABLEFISH

William L. High

Fish traps have been an effective capturing gear used by both sophisticated and primitive cultures for thousands of years. Recently, the concept has enjoyed a renewed interest because of improved construction techniques and the prime quality of fish captured--and because traps are often species-specific, thereby reducing waste of unwanted fish.

During the past three years, the NMFS Seattle Exploratory Fishing and Gear Research Base has carried out experimental fishing for sablefish (Anaplopoma fimbria) with various trap designs. A collapsible steel-mesh trap is now used by the R/V 'John N. Cobb' to estimate sablefish populations and their distribution along the Washington and Oregon coasts. The commercial fishing vessel M/V 'Seattle' has fished traps for sablefish intermittently for two years.

The fish-catch rates of traps may vary widely depending upon time of year and depths fished. The Seattle's most successful trip produced 50,000 pounds with 1,077 trap liftings in 14 days.

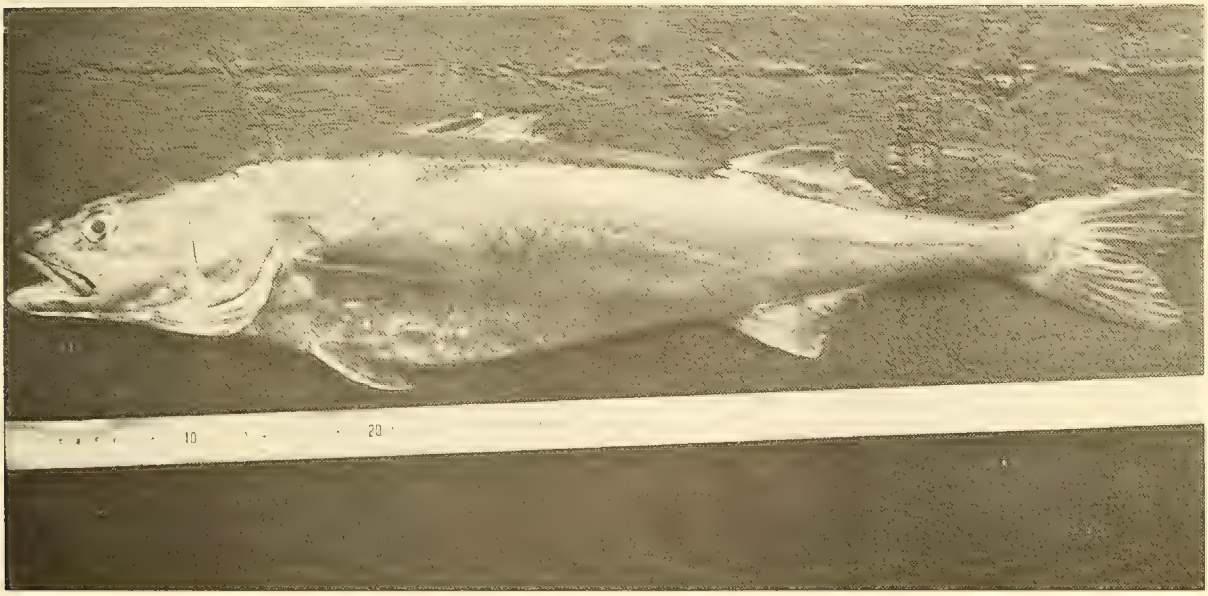

Fig. 1 - Sablefish (Anaplopoma fimbria), commonly called blackcod by west coast fishermen, are captured in deep water from California to Alaska. The fish has excellent flesh quality and is primarily kippered.

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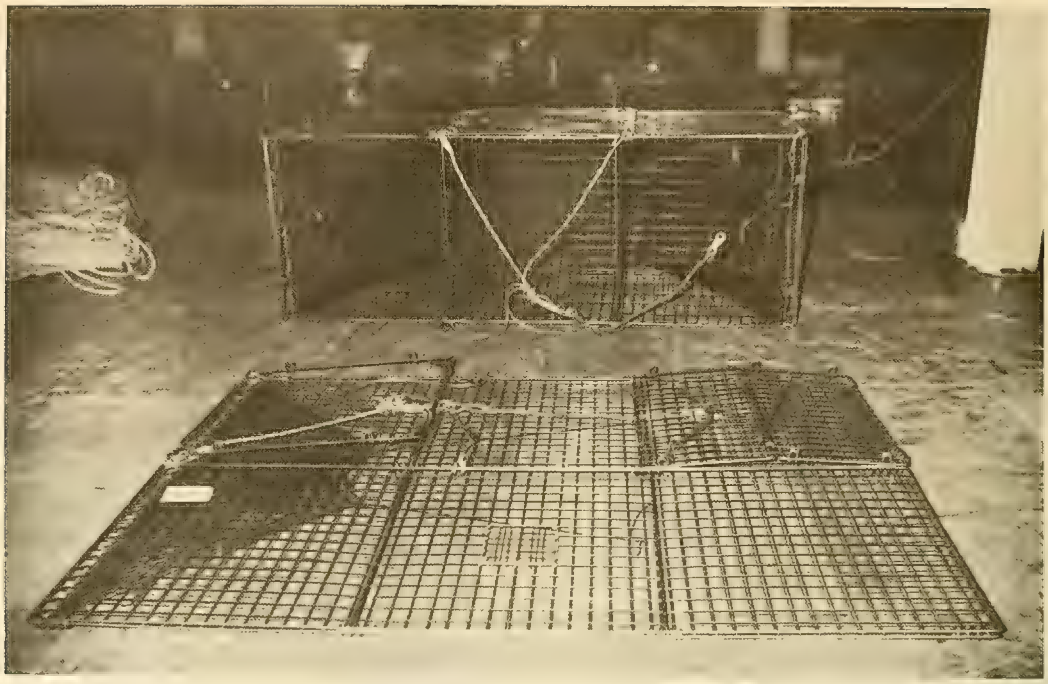


Fig. 2 - The collapsible trap currently used by NMFS is 34 inches by 34 inches by 8 feet long. Steel mesh is 2 inches square to allow small fish to escape. The trap will collapse flat for storage aboard a vessel. All trap parts remain connected, so one fisherman can reassemble a trap in less than one minute.

Fig. 3 - Trap side and end pieces are constructed individually, then joined by coiled springs. After each coil is spun into place by hand, the ends are crimped to prevent further movement. The coil also serves as a hinge when the trap is collapsed.

Fig. 4 - A spring-loaded snap hook at the end of the bridle permits the trap to be quickly connected or released from the groundline. Small rope loops (beckets) are placed at intervals (commonly 50 fathoms) in the groundline to space traps evenly.

Fig. 5 - Forty-five ready-to-assemble sablefish traps are shown on the after deck of the R/V John N. Cobb. When appropriately stacked for commercial fishing, a smaller vessel could carry 100 to 200 collapsed traps. Once assembled, traps are not collapsed unless the vessel moves to a distant fishing area. Trap strings are usually left to fish whenever the vessel returns to port to unload the iced catch.

Fig. 6 - Chopped frozen herring is placed in a plastic jar for each trap. Hundreds of small holes in the jar and lid permit oils and juices to escape--but prevent the bait from being devoured by sand fleas (anphipods). Bait handling is expedited by placing the jar into the trap loose rather rhan tying, as is done in other trap fisheries. It is done this way because studies suggest there is no increased catch for tied-up bait containers, and the used jar will fall out of the trap as fish are removed.

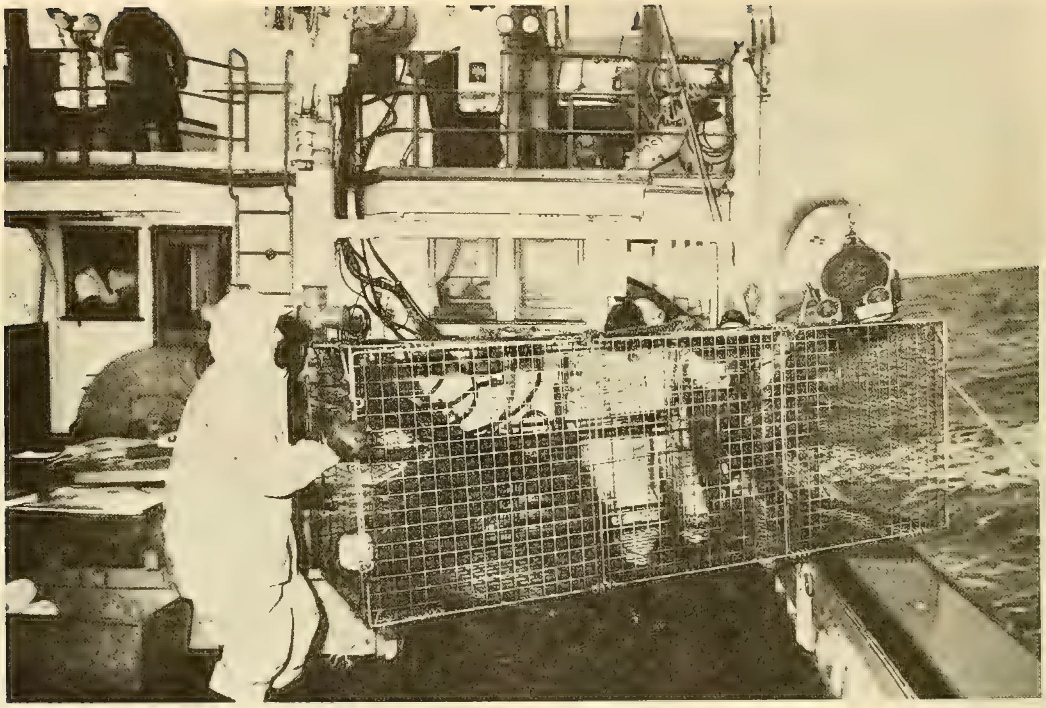


Fig. 7 - Traps are set at intervals along the groundline as it pays out through the hydraulic line hauler. Setting groundline under some tension tends to stretch the line along the ocean floor.

Fig. 8 - During experimental fishing, groundlines up to 600 fathoms long are coiled into a large wooden barrel (tierce) to facilitate handling the single line in rough seas.

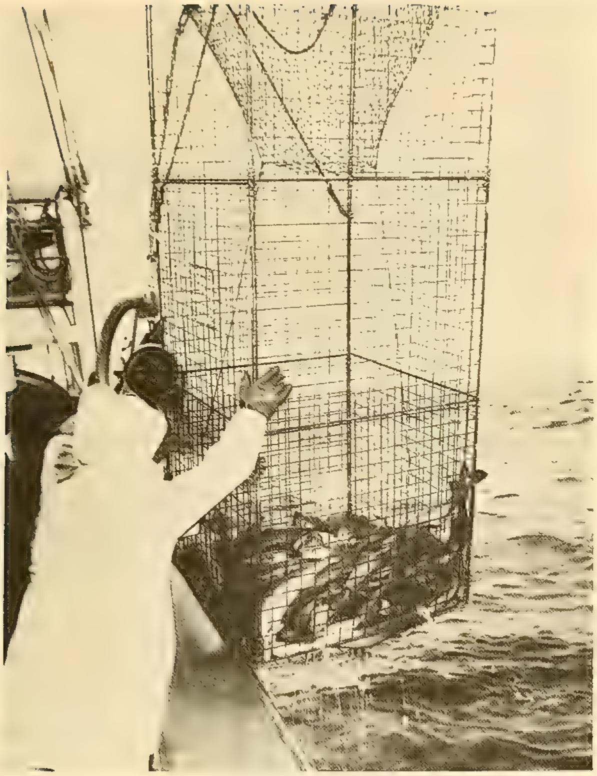


Fig. 9 - Upon surfacing, each trap is unclipped from the groundline and lifted aboard with the ship's hoist. Note the unique, ungated, tunnel orifice.

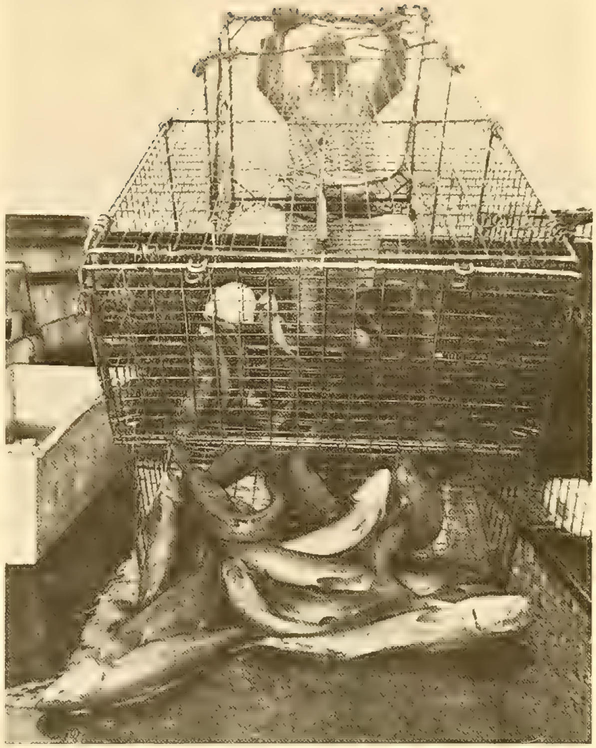


Fig. 10 - The hinged trap end piece is raised to dump both fish and the bait container. Before resetting, a fresh bait jar is placed in the trap.

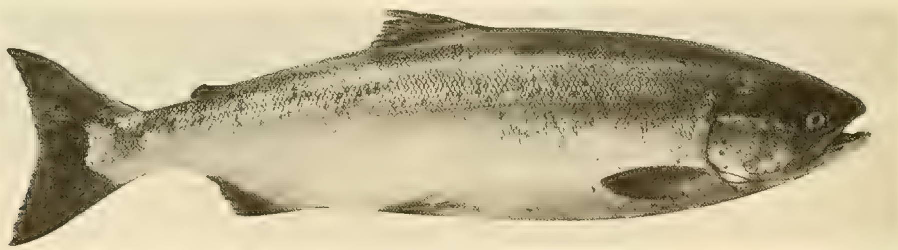
COHO SHAKER PROBLEM & INCIDENTAL CATCH CONCEPT IN TROLL FISHERY

Sam Wright

The term "shaker" is commonly applied to Pacific salmon (Oncorhynchus) taken in marine waters by commercial troll or sport hook-and-line gear but released due to closed seasons, minimum size limits, and market conditions. The problem stems from varying rates of mortality suffered by released salmon due to physical injury and the physiological trauma of being hooked. Without this loss, a significant percentage of these fish would become available to salmon fisheries when seasons opened, when they reached legal size, or when they migrated to areas and fisheries of differential regulations. Sublethal effects, such as slower growth and poorer condition, are also manifested.

incomplete data, the participants still agreed that the Pacific coast shaker salmon catch prior to June 15 might exceed 1,000,000 fish; up to 400,000 of these could be killed. Continuing research programs for British Columbia and California were bolstered by initiation of logbook programs and onboard observations in Oregon and Washington during 1970.

At 1970 meeting of Pacific Marine Fisheries Commission, past and present knowledge was presented in three parts: magnitude of catches, gear selectivity, and hooking mortality. A background paper documenting major regulatory statutes was presented at the



Silver (or Coho) Salmon (Oncorhynchus kisutch)

1969 Pacific Marine Fisheries Commission meeting.

Concern about the problem and sporadic studies date back to early stages of marine hook-and-line fisheries along the Pacific coast. Large-scale coordination by coastal salmon-management agencies began early in 1968 with emphasis on small chinook (O. tshawytscha) and coho (O. kisutch) in commercial troll fisheries. Canada and California led with initiation of logbook programs and gear-selectivity studies. These were due mainly to the impetus generated by recognition of serious problems with coho off the west coast of Vancouver Island and northern California.

Size of Problem

The magnitude of the problem was discussed in August 1968 at a Pacific Marine Fisheries Commission "Troll Salmon Workshop". Even with preliminary and admittedly

These basic data convinced the Washington Department of Fisheries that sufficient evidence was available for immediate positive action on the coho shaker problem, at least on a trial basis. It sponsored "Trial Regulation of the Troll Fishery to Reduce the Catch of Coho Shakers", Resolution No. 17, adopted at the 1970 Commission meeting.

INCIDENTAL COHO CATCH PROPOSAL

Although the general ocean troll salmon season begins April 15, it is illegal to retain coho hooked until June 15 on all fishing grounds north of California. The management rationale is simply to protect a population in its final year of life--while a tremendous growth potential still exists. For California,

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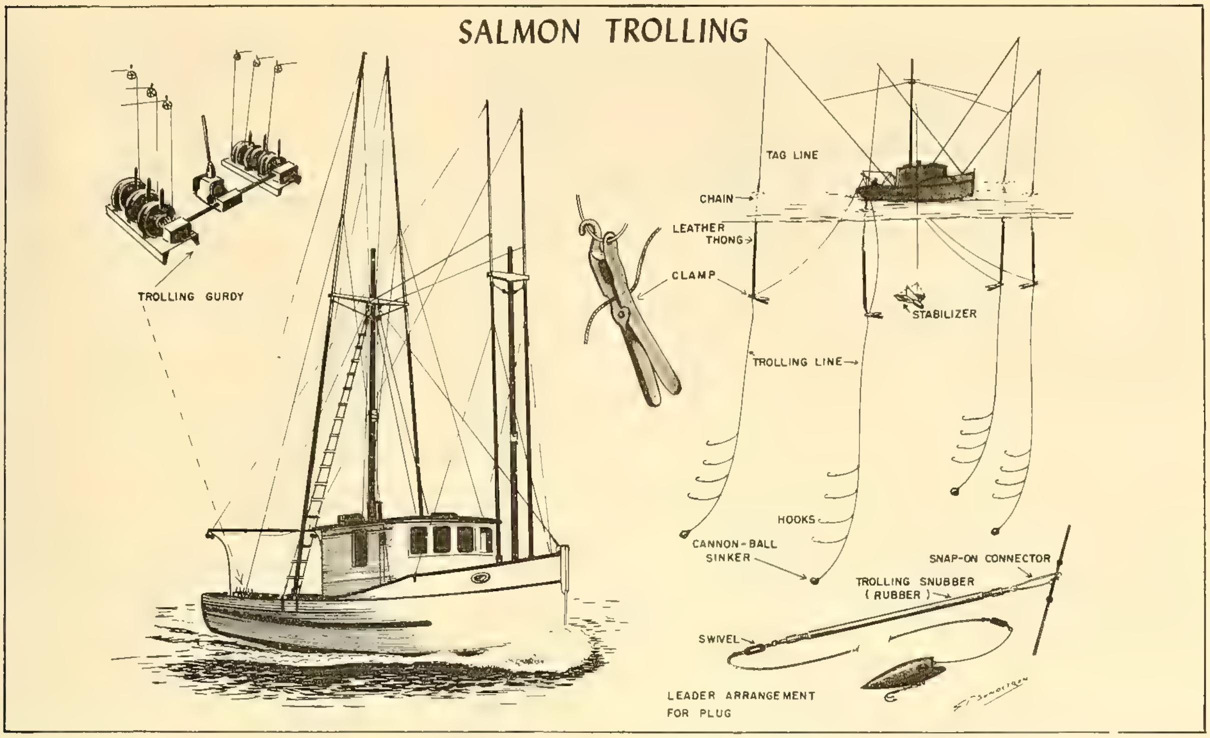

a 25-inch total length minimum is enforced for coho throughout the troll season; however, this falls at varying points in population's normal size distribution curve, depending on time of year and variations in growth rates. Differential protection to smaller fish of the same age-maturity class is the illogical result.

One key recommendation of PMFC Resolution No. 17 was a pre-June 15 incidental catch allowance for coho salmon poundage. This concept was based on the hypothesis that a coho's chances for survival could be determined reasonably well by visual observation as trolling gear brings them in. For example, recovery rates for three "condition categories" of live coho tagged during 1968 in outer Juan de Fuca Strait were:

Condition category	Number tagged	Number recovered	Percent recovered
"Good"	332	95	28.6
"Fair"	208	41	19.7
"Poor"	84	10	11.9

In the same study, 40 coho, or 6% of total catch, were completely expired when brought onboard. The intent, then, was to allow retention, and later sale, of coho brought onboard dead or badly injured--but to create no additional fishing effort (in terms of terminal gear, speed, depth, and/or area changes) specifically for this species.

TEST FISHERY

The incidental-catch concept received mixed blessings in nonsalmonid fisheries. It generated considerable speculation among Pacific coast management agencies. So a special test fishery was planned from June 1 to 5, 1971, off Grays Harbor. This is the center of Washington's spring-season trolling effort for chinook salmon.

Following a public information program, special permits were issued to 70 licensed troll vessels 16 to 50 feet long. These included members from tripboat, dayboat, kelper, and com-sport components and were representative of the total Grays Harbor fleet. The special permits stated: ". . . to retain coho salmon which are brought onboard dead or in a badly injured condition during his normal fishing effort for chinook salmon in the period June 1 through 5, 1971. Total poundage of these coho in a dressed condition shall not, however, exceed ten percent of the legal dressed chinook salmon poundage in possession of the fisherman. Further, all such coho

retained must be landed at the port of Westport, Washington, and relinquished to authorized Washington Department of Fisheries personnel. In compensation for the additional work effort required, the fisherman will be reimbursed at a rate per dressed weight pound equal to that established by industry for the regular coho season opening. There will be no minimum size limit for the coho."

From June 1 to 5, 51 permit holders landed chinook salmon at Westport, and 41 of these (80%) also landed coho. Weather conditions were exceptionally favorable. Both species were abundant throughout the 5-day period.

For 93 individual landings, the following were recorded:

Number chinook	-	2,313
Pounds chinook	-	25,855
Average weight	-	11.18 lbs.
Number coho	-	541
Pounds coho	-	2,268
Average weight	-	4.19 lbs.

Coho appeared in 67 landings, 8.8% of chinook catch on basis of weight, and 23.4% on basis of numbers. Ice boats, in 16 deliveries, accounted for 72.8% of chinook poundage, and 69.1% of coho poundage; day fishermen contributed the remainder in 77 individual landings. A few fishermen exceeded the 10% limit on coho deliberately or accidentally because they misunderstood terms of special permit. Subtracting these from total indicates that overall coho poundage level of 6% of chinook poundage would be realistic for predicting outcome of such a fishery on a regular basis.

In spite of a period for continued growth, a sample of troll coho taken off Grays Harbor after the regular season opening on June 15 averaged only 3.80 lbs. dressed. It appeared that terminal gear fished for chinook during the test fishery was more selective toward larger individuals of the available coho population.

Fisherman Reaction

In general, comments from fishermen participating in the study were favorable. Most learn quickly to estimate coho allowance percentage reasonably accurately during fishing. The test fishery might have been less successful if either chinook or coho abundance had been considerably less than prevailed. Most trollers were consciously selecting dead and badly injured coho for retention, but little objective data could be obtained from landed fish, particularly when dressed.

Unfavorable results from previous studies plus the troller's natural aversion to wastage ("belly burning" of coho in the round) prevented any request for landing coho uncleaned. The adverse comments on incidental catch allowance were mainly fears that landing of coho before regular June 15 season opening might have adverse affects on fishermen's price negotiations with industry.

RECOMMENDATIONS

To alleviate one specific component of Pacific coastal shaker salmon problem (preseason coho wastage), it is recommended that regulations be changed to allow a 10% coho allowance prior to June 15 on 1-year trial basis. During this full-scale test, detailed evaluation should be conducted, particularly through onboard observations of fishing operations.

ACKNOWLEDGMENTS

The troll coho test fishery was financed by Project No. 1-55-R-1, Ocean Salmon Fisheries Sampling, Commercial Fisheries Research and Development Act (PL 88-309).

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FISHERY BIOLOGY

"Fishery Bulletin" of the National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Department of Commerce, Vol. 69, No. 2, April 1971, pp. 253-453, illus., contains 19 technical reports on investigations in fishery science.

Bulletins are distributed free to libraries, research institutions, State agencies, and scientists. Some bulletins are sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

"Swimming Speed, Tail Beat Amplitude, and Size in Jack Mackerel, Trachurus symmetricus, and Other Fishes," by John R. Hunter and James R. Zweifel, pp. 253-266.

"The objective of the study was to determine the relationships between swimming speed, fish length, tail beat amplitude, and tail beat frequency in a pelagic marine fish, jack mackerel, Trachurus symmetricus. To accomplish this objective, dorsal cine photographs were taken of fish swimming in currents of different speeds in a specially designed activity chamber. For comparative purposes tests were also run on three other marine fish: chub mackerel, Scomber japonicus; Pacific sardine, Sardinops sagax; and a shark, Triakis henlei."

"Sustained Speed of Jack Mackerel, Trachurus symmetricus," by John R. Hunter, pp. 267-272.

The purpose of this study was "to determine the sustained speed threshold of jack mackerel, Trachurus symmetricus, a pelagic marine fish of commercial importance. The body form and musculature of Trachurus appear to be designed for greater hydrodynamic efficiency at high speeds than other species heretofore studied. In Trachurus, lateral musculature is concentrated in the anterior portion of the trunk, and inserts by tendons on a small deeply forked caudal fin."

There is interest in comparing the sustained speed capabilities of Trachurus with that of fish with other body forms. Also, sustained speed data are significant in predicting migratory capabilities and physiological limits.

"The Transplanting and Survival of Turtle Grass, Thalassia testudinum, in Boca Ciega Bay, Florida," by John A. Kelly Jr., Charles M. Fuss Jr., and John R. Hall, pp. 273-280.

This article describes the procedures for and results of transplantation of turtle grass into modified environments. "Turtle grass was transplanted to an unvegetated, dredged canal and a hand-cleared portion of a flourishing grass bed. Complete or partial success was attained in 7 of 14 methods used. The best method, in which short-shoots (rhizomes removed) were dipped in a solution of plant hormone (Naphthalene Acetic Acid) and attached to construction rods for transplanting, was 100% successful and may be suitable for general application."

"Effect of Dietary Fish Oil on the Fatty Acid Composition and Palatability of Pig Tissues," by Robert R. Kifer, Preston Smith Jr., and Edgar P. Young, pp. 281-302.

This report deals with the problem of a "fishy" flavor in the meat of pigs. This flavor results sometimes when pigs are fed fishery products--fish meal, for example, above a certain concentration in the diet.

Pigs were fed diets containing fish oil to investigate: (1) the effect on the taste of meat of feeding fish oil to pigs, (2) the effect, on taste of meat, of withdrawing the oil from the

diet at given times, (3) the fatty acid composition of the body tissues of the pigs, and (4) the relation of composition to meat taste.

"Cetaceans from the Lesser Antillean Island of St. Vincent," by David K. Caldwell, Melba C. Caldwell, Warren F. Rathjen, and John R. Sullivan, pp. 303-312.

The authors present a preliminary list of cetaceans collected and observed in a fishery for blackfish or pilot whales (Globicephala) in waters of Lesser Antillean Island of St. Vincent. Nearest published records in the western Atlantic are given; also, limited biological notes on some species. The taxonomic relationships of the two forms of Stenella are suggested; both species are illustrated. Landings of pilot whales in the fishery over a 9-year period are included.

"Contributions to the Biology of the Royal Red Shrimp, Hymenopenaeus robustus Smith," by William W. Anderson and Milton J. Lindner, pp. 313-336.

The royal red shrimp, Hymenopenaeus robustus, has been located in commercial concentrations in three areas off the United States about 250 to 550 m deep: (1) the St. Augustine Grounds off Florida's east coast; (2) off Dry Tortugas; and (3) off Mississippi River Delta.

The authors collected information intermittently on the biology of the St. Augustine species.

The reproductive systems of males and females are described and illustrated. Burrowing and swimming habits observed from research submarine 'Aluminaut' are summarized.

"Sex Pheromone Activity of the Molting Hormone, Crustecdysone, on Male Crabs (Pachygrapsus crassipes, Cancer antennarius, and C. anthonyi)," by James S. Kittredge, Michelle Terry, and Francis T. Takahashi, pp. 337-344.

"The pheromone released by permolt female (Pachygrapsus crassipes) is a heat-stable non-ionic polar lipid. The coincidence of the release of the pheromone and the nubial molt suggested that the molting hormone, crustecdysone, may also function as a sex pheromone. Adult male crabs were observed to display typical precopulatory behavior when exposed to dilute solutions of crustecdysone." Threshold concentrations for behavioral response were found. These provide basis for a theory of the evolution of pheromone communication in the Arthropods.

"Characteristics of Sea-Surface Temperature Anomalies," by L.E. Eber, pp. 345-356.

"Sea-surface temperature anomalies in the North Pacific Ocean, constructed from a 14-year series (1949-62) of monthly mean charts, exhibit numerous instances of quasi-stationary behavior." Selected examples show a recurring pattern. The principal feature is a positive or negative cell in anomaly field between lat. 30° N and 50° N.

"Induced Spawning of the Northern Anchovy, Engraulis mordax Girard," by Roderick Leong, pp. 357-360.

"This report describes a method for bringing the anchovy to ripeness and the effectiveness of various hormone treatments in inducing spawning. As far as is known this was the first successful attempt to artificially mature and spawn this pelagic fish in the laboratory."

"Gill Raker Apparatus and Food Selectivity Among Mackerels, Tunas, and Dolphins," by John J. Magnuson and Jean G. Heitz, pp. 361-370.

This article describes quantitatively the gill raker apparatus of certain scombrids and coryphaenids with respect to the gap between gill rakers and filtering area of first gill arch; compares differences in gill raker gap among species and fish lengths; and considers proposition that observed inter- and intraspecific variations in the diet are associated functionally with morphometrics of gill raker apparatus.

"Nature of Free Radicals in Freeze-Dried Fishery Products and Other Lipid-Protein Systems," by William T. Roubal, pp. 371-377.

The article deals with recent research using systems which, for first time, are favorable for detection and study of electron

paramagnetic resonance (ERP) spectrometer signals that arise with onset of lipid oxidation. Mechanisms for forming radicals and reactions of radicals are discussed.

"The Relation Between Exercise and Biochemical Changes in Red and White Muscle and Liver in the Jack Mackerel, Trachurus symmetricus," by Austin W. Pritchard, John R. Hunter, and Reuben Lasker, pp. 379-386.

This study reexamined the "metabolic and locomotor roles of red and white muscle by measurement of glycogen, lactate, and fat levels in the muscle and glycogen levels in the liver in fish exposed to various velocity treatments of known strength and duration. Juvenile jack mackerel, Trachurus symmetricus, were used because the maximum sustained speed threshold for 6 hours of continuous swimming had been established for it--and all chemical measurements were related to known levels of swimming performance.

"Sebastes variegatus, Sp. N. from the Northeastern Pacific Ocean (Pisces Scorpaenidae)," by Jay C. Quast, pp. 387-398.

"A new scorpaenid fish, Sebastes variegatus, from the Gulf of Alaska is characterized by an elongate body that tapers symmetrically anteriorly and posteriorly; presence of preocular, postocular, tympannic, and parietal spines and lack of supraocular, coronal, and (usually) nuchal spines; 18 (rarely 17 or 19) rays in the pectoral fin; a second anal fin spine that is longer than the third; black membranes in the spinous dorsal and caudal fins; a dark brown to jet black peritoneum; and a dark blotched pattern on the sides that is interrupted over the posterior 2/3 of the body by an unpigmented band along the lateral line. The known geographic range is from Unimak Pass (Aleutian Islands) to Queen Charlotte Sound (British Columbia)."

"Calico Scallop Distribution, Abundance, and Yield Off Eastern Florida, 1967-68," by Richard B. Roe, Robert Cummins Jr., and Harvey R. Bullis Jr., pp. 399-410.

In an 18-month period, Aug. 1967-Dec. 1968, the NMFS Exploratory Fishing and Gear Research Base in Pascagoula, Miss., surveyed the calico scallop (Argopecten gibbus) grounds off eastern Florida. The survey disclosed aspects of life history, distribution, abundance, and yield and annual variation in geographical and depth distribution.

"Effects of Delayed Initial Feeding on Larvae of the Grunion, Leuresthes tenuis (Ayres)," by Robert C. May, pp. 411-426.

The purposes of this study were "to determine the effects of delayed initial feeding on mortality, on growth, and on the ability of grunion (Leuresthes tenuis) larvae to begin feeding and to utilize ingested food, and to ascertain what changes in the morphology and chemical composition of the larval body occur during starvation."

"The Relative Sampling Performance of 6- and 10-foot Isaacs-Kidd Midwater Trawls," by William A. Friedl, pp. 427-432.

This report deals with the relative sampling abilities of two sizes of Isaacs-Kidd midwater trawl (IKMT), a type of net used widely in marine and freshwater investigations. The results apply to IKMT in general; the assessment explains the degree to which data obtained with different trawls are comparable.

"Studies on the Use of Carbon Dioxide Dissolved in Refrigerated Brine for the Preservation of Whole Fish," by Harold J. Barnett, Richard W. Nelson, Patrick J. Hunter, Steven Bauer, and Herman Groninger, pp. 433-442.

Storing fish in refrigerated seawater has many advantages over storing them in ice, but the former also has disadvantages; one is the difficulty in controlling growth of spoilage bacteria in the fish. This article reports the effect on growth of bacteria in rockfish and chum salmon of dissolving carbon dioxide in brine. Storing fish in refrigerated brine treated with carbon dioxide inhibited bacteria growth, retarded rate at which fish decrease in quality, and increased their storage life by at least 1 week.

"DDT Residues in Seawater and Particulate Matter in the California Current System," by James L. Cox, pp. 443-450.

"Continuous samples of seawater and organic particulate material collected along

linear transects in the California current system were analyzed for DDT residues." DDT residue concentrations in whole seawater is determined. Geographical patterns in these concentration values are discussed in relation to mechanisms of land-sea DDT residue transfer. The author describes experimental results that implicate adsorption as the uptake mechanism for algal cells.

"Egg Loss During Incubation from Offshore Northern Lobsters (Decapoda: Homaridae)," by Herbert C. Perkins, pp. 451-453.

"Egg loss during incubation from offshore northern lobsters, Homarus americanus Milne Edwards, was estimated by counting the eggs of 196 females. The lobsters were captured along the continental shelf off southern New England during October (eggs recently extruded), April, and June (eggs nearly ready to hatch). Egg loss during the period October to June averaged 36% for females of all sizes studied."

THE FOLLOWING PUBLICATIONS OF THE DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE, ARE AVAILABLE FREE FROM DIVISION OF PUBLICATIONS, NOAA, CONNECTICUT AVE. & VAN NESS ST. NW., BLDG. 52, WASHINGTON, D.C. 20234:

DISCOLORATION IN CANNED CRAB MEAT

"Blueing of Processed Crab Meat. II. Identification of Some Factors Involved in the Blue Discoloration of Canned Crab Meat (Callinectes sapidus)," by Melvin E. Waters, SSR-Fisheries No. 633, 7 pp., illus., May 1971.

An outbreak of blue discoloration in canned crab meat occurred during 1969. Mr. Waters reports the result of a study to pinpoint the cause of blueing and suggest a remedy.

Results showed that iron was involved in the discoloration. Also, that a buffered solution of citric acid (pH 6.5-6.8) prevented formation of the blue-colored complex.

MECHANICAL PROCESSING OF BAY SCALLOP MEATS

"Influence of Mechanical Processing on the Quality and Yield of Bay Scallop Meats," by N. B. Webb and F. B. Thomas, SSR-Fisheries No. 624, 11 pp., illus., April 1971.

The commercial method of shucking bay scallops by hand is costly. A mechanical method has been developed to reduce costs while maintaining or improving quality of processed meats.

Shell stock loading conveyor for delivery to the rotating metal rollers.

This study compared quality and yield of bay scallops processed by mechanical means with corresponding values of those processed by typical hand method. The mechanical method included heat-shocking of the shell-stock, roller-vibration removal of the meats and viscera, and later separation of viscera from meats.

The results indicate that quality and yield of meats from bay scallops processed mechanically "is equivalent to quality and yield of those processed commercially by hand."

FLOATING LABORATORY

"Floating Laboratory for Study of Aquatic Organisms and Their Environment," by George R. Snyder, Theodore H. Blahm, and Robert J. McConnell, Circular 356, 16 pp., illus., May 1971.

The National Marine Fisheries Service built a floating laboratory to study environmental problems in the Columbia River. The barge that supports the lab was provided by the U.S. Navy. A complex electrical and water-supply system, plus biological research equipment, were installed aboard barge. These made it possible to conduct research near sites where problems are expected to occur.

CALIFORNIA MARINE FISH CATCH

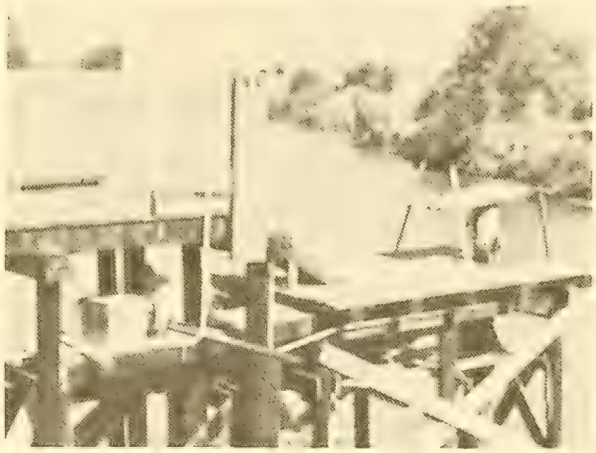
"The California Marine Fish Catch for 1969," by Leo Pinkas, Fish Bulletin 153, 47 pp., 2 figs., 24 tables, and an appendix, 1970. Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814.

This bulletin provides records of amounts and values of some living marine resources taken by California's commercial fisheries in 1969. It summarizes catches by partyboat sportfishing industry. The small quantities of freshwater fish taken commercially in inland areas are also detailed.

KING SALMON

"Migrations of Adult King Salmon (Oncorhynchus tshawytscha) in the San Joaquin Delta (As Demonstrated by the Use of Sonic Tags)," by Richard J. Hallock, Robert F. Elwell, and Donald H. Fry Jr., Fish Bulletin 151, 92 pp., 22 figs., 11 tables, 6 appendices, 1970. Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814.

Each fall king salmon pass through the Sacramento-San Joaquin Delta bound for the Sacramento and San Joaquin River systems. Starting in 1961, salmon runs of the San Joaquin, but not Sacramento's, suffered disaster.



Monitor housed on an irrigation pump platform, San Joaquin River near Bowman Road, fall 1965. (Photo: John A. Shaver)

This was due probably to water conditions in San Joaquin part of Delta. From 1964 through 1967, salmon tagged with sonic tags were released in Delta's central part to determine their reaction to low oxygen levels and reversed flows. Electronic equipment enabled researchers to follow tags and record their movement past fixed points. Salmon avoided water with less than 5 ppm dissolved oxygen by staying farther downstream until oxygen block cleared. Temperatures over 66° F. had a similar, but less sharply defined, effect.

INDEX

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BACK COVER: Drying longline gear at Kewalo Basin, Honolulu. (H. Mann)